BRITISH BATTLESHIPS 1914–18 (2)

The Super Dreadnoughts

ANGUS KONSTAM

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NEW VANGUARD 204

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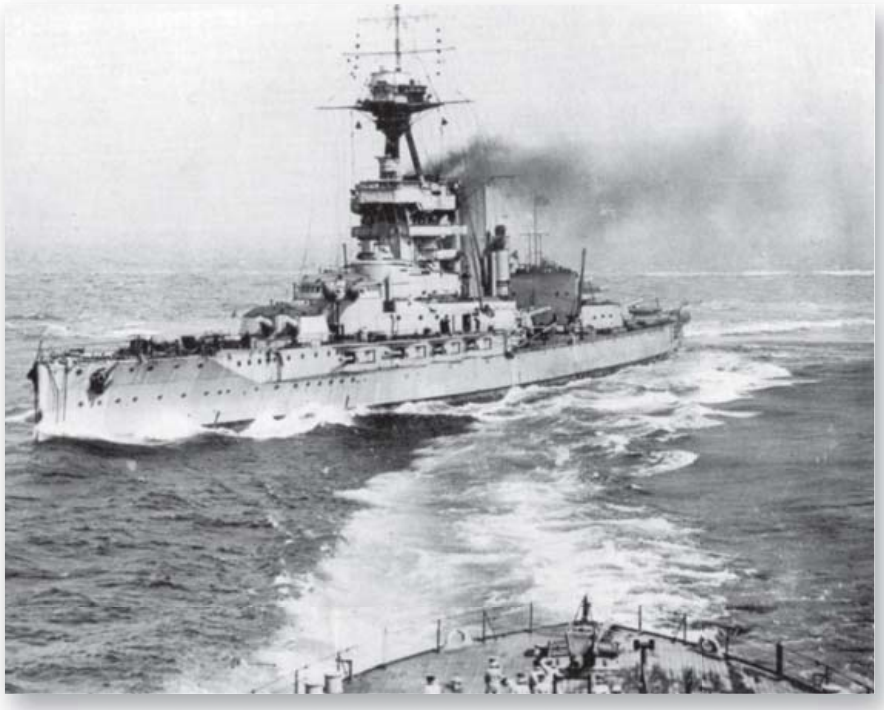

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CONTENTS

INTRODUCTION 4

DESIGN AND DEVELOPMENT 6
- Orion Class
- King George V Class
- Iron Duke Class
- Queen Elizabeth Class
- Royal Sovereign Class
- HMS *Erin*
- HMS *Canada*

SPECIFICATIONS 28

WARTIME MODIFICATIONS 31
- Orion Class
- King George V Class
- Iron Duke Class
- Queen Elizabeth Class
- Royal Sovereign Class
- HMS *Erin*
- HMS *Canada*

CAMOUFLAGE 37

THE WARTIME FLEET 40

WARTIME SERVICE 42
- Orion Class
- King George V Class
- Iron Duke Class
- Queen Elizabeth Class
- Royal Sovereign Class
- Other Super Dreadnoughts

BIBLIOGRAPHY 47

INDEX 48

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BRITISH BATTLESHIPS 1914–18 (2)
THE SUPER DREADNOUGHTS

INTRODUCTION

By 1909, Great Britain was in the middle of an arms race. Since the completion of HMS *Dreadnought* in December 1906, the British Admiralty had been eager to expand its dreadnought fleet as rapidly as possible, before its naval rivals could do the same. The German response was to commission its own dreadnoughts, the first of which were laid down in the summer of 1907. From that moment the gloves were off, as both countries tried to expand their battle fleet as quickly as they could. Matters reached a head in March 1908, when the German Reichstag approved the funding for the building of four dreadnoughts a year. Naval analysts predicted that by 1914 the German dreadnought fleet would have achieved parity with that of the British.

Then there were the disquieting reports that the Germans were considering arming future dreadnoughts with 35cm (13¾-inch), rather than the 30cm (12-inch) main guns that their navy currently favoured. Not only would these new guns have a longer range than British 12-inch dreadnought guns, but they would also be able to penetrate the armour of almost all the dreadnoughts in the British fleet. Admiral Fisher's dictum of 'Build first, build fast, each one better than the last' would no longer be enough. There was nothing else for it – Britain had to build better-armed dreadnoughts, or risk losing her hard-won naval dominance.

The Grand Fleet at anchor in Scapa Flow, captured by the artist Sir John Lavery in December 1917. The viewpoint is from the highest point of the island of Flotta and looks across the main anchorage towards the Orkney mainland around Orphir.

The result was the design of a new generation of 'super dreadnoughts', armed with 13.5-inch guns. However, as with everything else during this period, speed of construction outweighed almost every other consideration. Once the decision had been made to build this new generation of dreadnoughts around the larger gun, other innovations fell into place, such as the need to mount guns along the centreline, or to reconfigure accommodation within the hull. The first of these super dreadnoughts entered

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The Battle of Jutland, fought on 31 May 1916, was the only time most of the dreadnoughts of the Grand Fleet fired their guns in anger. Most only fired a few salvos before the German High Seas Fleet broke off the action.

service in 1912, by which time plans were already drawn up for an even more potent type of capital ship.

Even here, the impetus for change came from abroad rather than from the dmiralty. American and Japanese dreadnoughts were being built with 14-inch guns, while intelligence reports suggested that the Germans were designing capital ships to carry 38cm (15-inch) ordnance. This prompted another revision of British dreadnought design. The result was the Queen Elizabeth and Revenge classes, the former being generally considered the best all-round battleships of the war.

Of course, the real test of British warship design would come when these great leviathans were called upon to fire their guns in anger. For most super dreadnoughts this chance only came once, at the Battle of Jutland, and even then their moment of martial glory was a fleeting one. Many of these ships only managed to fire a handful of salvos at the enemy, and so they were never fully tested in the fire of battle. However, by then they had already achieved their purpose.

As a 'fleet in being', their very existence prevented the Germans from risking another wartime clash, and so they played a vital albeit unspectacular part in the continued blockade of Germany. This blockade, more than anything else, contributed to the final collapse of Germany's will to fight. In other words, victory was won by the likes of *Iron Duke*, *Thunderer* and *Warspite*, whether these great ships fought the enemy or not. The Admiralty put this very succinctly in November 1918, following the surrender of the German High Seas Fleet. It said: 'The surrender of the German fleet accomplished without shock of battle will remain for all time the example of wonderful silence and sureness with which sea power attains its ends.' One can hardly think of a better testimony.

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DESIGN AND DEVELOPMENT

The roots of the super dreadnought lay in a report written in 1909 by the Director of Naval Ordnance (DNO), Rear Admiral Hugh Baron. He claimed that the 12-inch 50-calibre gun used in the latest dreadnoughts was inaccurate, as it 'wobbled' in flight. He argued that by adopting the lower velocity 13.5-inch gun this problem would be eradicated, while the larger shells would also enjoy a greater range and hitting power. Around this time new methods of gunnery direction and fire control were being adopted, and the range at which a naval battle was expected to be fought was increasing steadily. It was felt that the larger guns with their larger range represented a logical step forward. These guns offered a useful increase in range, penetration and explosive power, while it was felt that the 12-inch gun had reached its limit in terms of performance.

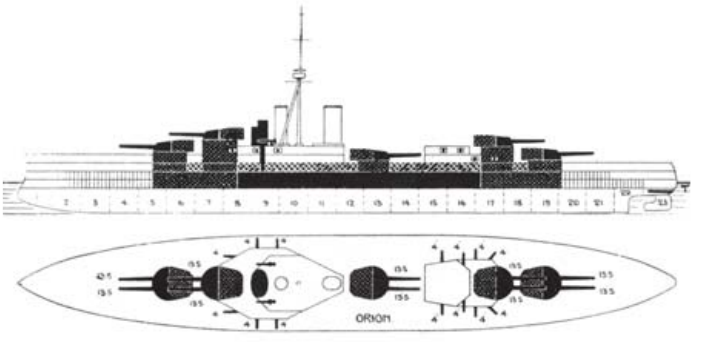
The Admiralty accepted the DNO's arguments, but while they approved the adoption of the larger calibre of gun, they also wanted to keep this secret. So, during the building of the first 'super dreadnoughts', these guns were officially labelled as '12-inch A' weapons. Fortunately these larger guns had already been designed and built, and were currently being evaluated. The decision was made to fit them into the next batch of four dreadnoughts to be built – the warships earmarked for construction in the 1909 programme of ship construction. These warships were intended to become the Orion class, the first of Britain's 'super dreadnoughts'.

Orion Class

The decision to mount the 13.5-inch Mark V breech-loading (BL) gun in Britain's latest class of dreadnoughts might well have caused significant problems for the Director of Naval Construction (DNC) Sir Philip Watts, had e not been fully prepared for this development. In fact, as DNC, Watts had already called for plans for a new class of dreadnought, where the main gun turrets were all mounted along the vessel's centreline. In line with the Fisher dictum, he specified that the design would be similar to that of the Colossus class, but modified to embrace this new turret configuration. From there it was a relatively simple matter to replace the turrets with those designed to carry a 13.5-inch rather than a 12-inch gun.

Because the increase in gun calibre was expected to be repeated by Britain's rivals, it was felt that the warships of the Orion class needed better armoured belt protection than their predecessors. A lesser degree of armour was also added to the 'soft ends' of the belt towards the stem and stern.

The added weight of these turrets meant that the arrangement of the turrets along the centreline was inevitable, in order to make the ship as stable as possible. This in turn meant that 'B' and 'X' turrets had to be superimposed, so they could fire over 'A' and 'Y' turrets. The problems of superimposing turrets had already been overcome, as 'X' turret in *Neptune* and the Colossus class was designed to fire over the aftermost turret. All the designers had to do was to repeat the arrangement with 'B' turret, and replace the two wing turrets with a single centreline mounting – 'Q' turret. The actual number of turrets remained the same; only their configuration was altered.



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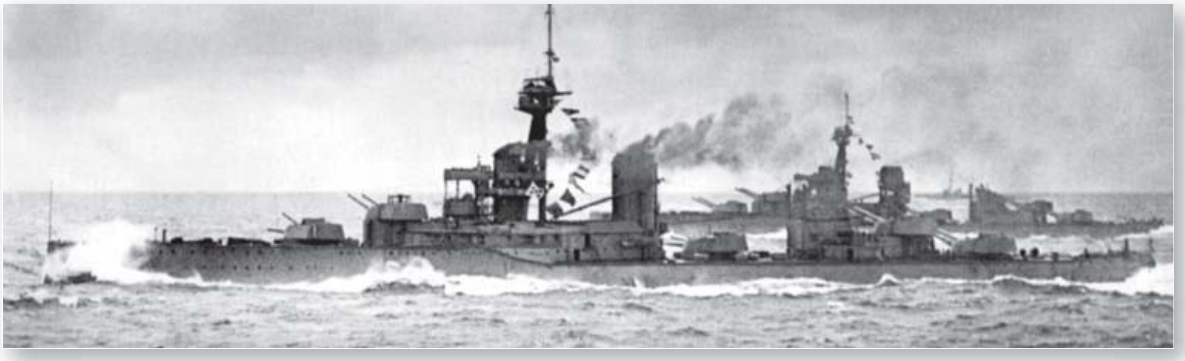

The Orion-class super dreadnought HMS *Conqueror*, on patrol in the North Sea in May 1917 accompanied by a sister ship, possibly *Monarch* or *Thunderer*.

To make things simpler, the 12-inch gun mounting used on the St Vincent class was adapted to take the larger gun, becoming the 13.5-inch Mark II mount. Even the navy's handbook for the gunners claimed the two were very similar, although the new larger guns had a stronger slide mechanism, new gun-firing electrical circuits, and a more powerful 'swashplate' engine, to speed up training the turret round. The supply trunking, which brought the cordite up to the turret, was also altered. As the turret was approximately the same size as those used for 12-inch guns, space was at a premium inside the gun house. Still, this all helped the design process, as adapting existing designs was much simpler and faster than creating new ones from scratch.

The building of the four Orions was approved by the Liberal government in early 1909, despite the opposition of the prime minister, and the DNC began the process of modifying their designs. One version called for a ship displacing 24,250 tons, over 4,000 tons more than the Colossus class, and capable of making 23 knots. In June the Admiralty considered the preliminary designs, and opted for a compromise version, displacing 22,500 tons and capable of making 21 knots. This ran contrary to the advice of the DNC, who argued that new German ships would be faster than their British counterparts. This compromise ship, known as Design 'L', was duly approved by the Admiralty in November.

The big difference between the Colossus class and the Orions was their increased displacement, a by-product of the arrangement of the armour along the centreline, and the consequent need to make the protective belt longer than before. The weight was also increased because the side armour was extended all the way up to the main deck – something that had not been done previously. The belt was also an inch thicker amidships than in *Colossus*, but to save weight the deck armour and internal protection was less. Sir Philip Watts had also wanted to increase the beam of these ships to provide a more stable gun platform and to permit space for added underwater protection against enemy torpedoes. This was vetoed by the Admiralty, and so only a modest beam increase of 3½ feet was approved, in line with the added length of the hull. In the end these ships were 31 feet longer than their predecessors and just over 2,000 tons heavier.

The decision to retain a 4-inch secondary armament for the Orion class was probably ill-considered, another consequence of adopting a basic design based on the Colossus class. The foremast was also mounted behind the forward funnel, as it was in the earlier class, even though it was known that smoke would partly obscure the vision of the gun directors in the control top. Again, this was a result of using the Colossus blueprints without making

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HMS *Orion*, namesake of her class, pictured during the surrender of the German High Seas Fleet in November 1918. Note the aircraft mounted on a flying off platform on top of 'B' turret, and the deflection markings on 'B' and 'X' turrets.

the changes recommended by experience.

This also led to a repeat of the internal arrangement of the earlier class, with officers quartered forward and other ranks aft. While the Admiralty would have preferred a return to the more traditional arrangement of officers berthed beneath the quarterdeck, there simply wasn't time to incorporate this rearrangement in the plans. Therefore, the Orion-class ships were among the last British dreadnoughts to favour Fisher's radical rearrangement of living quarters, where the officers were berthed according to practicality rather than tradition.

In the end the Orion class more than proved their worth. They entered service during 1912, and with their larger guns and new gun direction systems they were excellent gun platforms, and greatly improved the fighting potential of the fleet. They also provided a useful base from which to design subsequent classes of super dreadnoughts.

Ship	Builder	Laid Down	Launched	Completed	Fate
Conqueror	Beardmore, Clydeside	5 April 1910	1 May 1911	November 1912	Sold and broken up 1922
Monarch	Armstrong, Tyneside	1 April 1910	30 March 1911	April 1912	Sunk as a target 1925
Orion	Portsmouth Dockyard	29 November 1909	20 August 1910	January 1912	Sold and broken up 1922
Thunderer	Thames Iron Works, London	13 April 1910	1 February 1911	June 1912	Sold and broken up 1926

King George V Class

Approved in the 1910 budget, the four ships of what would become the King George V class were originally going to be direct copies of the Orions. Fortunately, a number of modifications were made, either due to experience

A

HMS *THUNDERER* (ORION CLASS)

The launch of HMS *Orion* signalled the greatest change in British warship design since the launch of *Dreadnought* six years before. She was the first of the 'super dreadnoughts', carrying 13.5-inch guns rather than the 12-inch barrels mounted in previous dreadnoughts. This meant they fired a 1,250-pound projectile rather than an 850-pound one, which, although it had a lower velocity, had a much greater destructive power. These guns were installed in five twin turrets. Unlike previous dreadnoughts, these super dreadnoughts carried all their main gun turrets on their centreline. This represented the way forward: an abandonment of the notion that dreadnoughts were just as likely to engage the enemy in their bow or stern arcs as on their beam, as part of a battle line. In effect it presaged a return to the tactics of the 'Age of Fighting Sail', where warships deployed in line astern. *Thunderer* was the third super dreadnought of the class to enter service and the last capital ship to be built on the River Thames. She entered service in the summer of 1912 and in July 1914 she joined the newly formed Grand Fleet. This plate represents her appearance shortly after the outbreak of war, after her hull was repainted in mid-grey.

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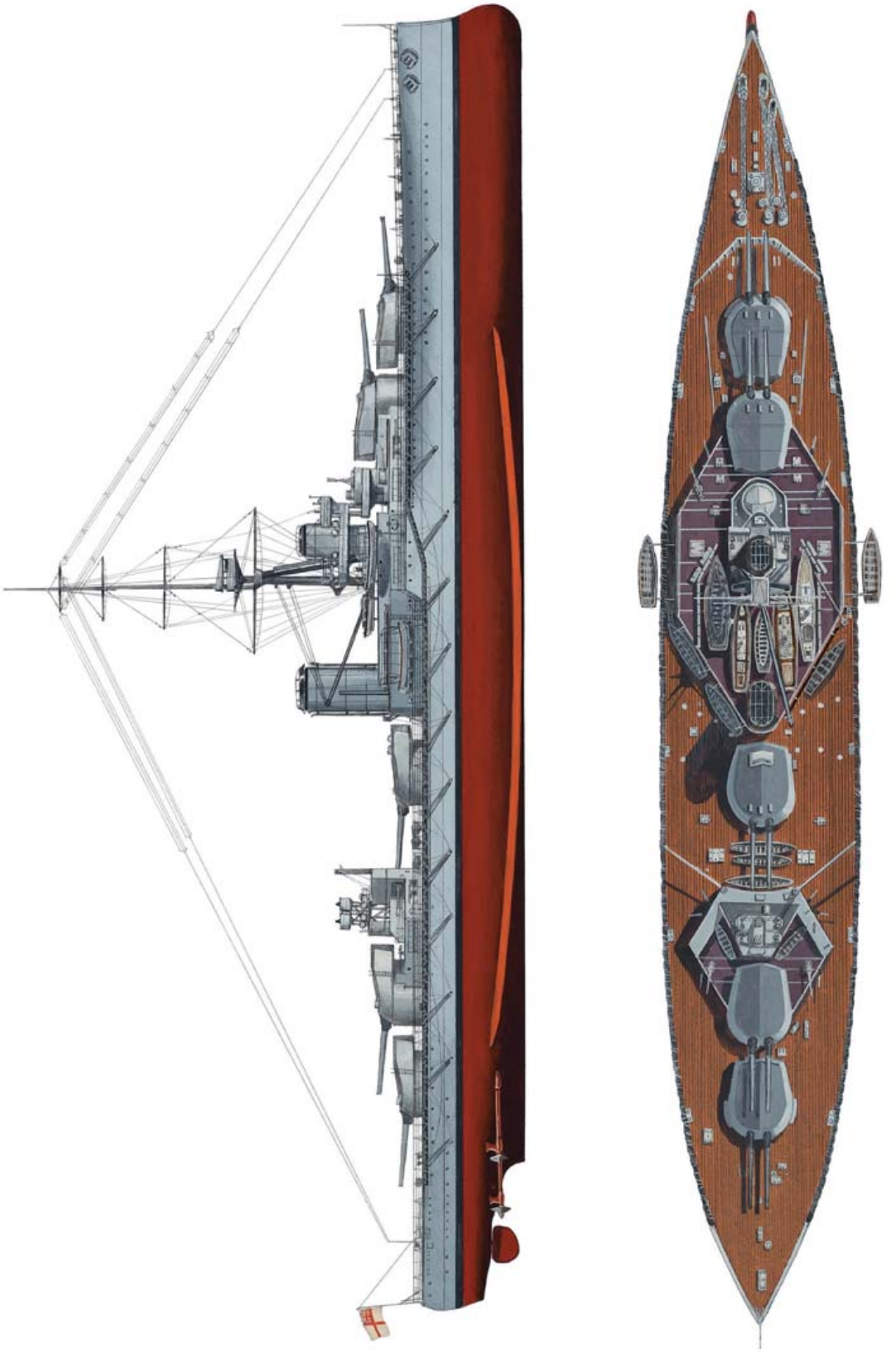

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In this view showing the forward gun turrets of the King George V-class super dreadnought *Ajax*, a black and white deflection scale can be seen painted on the sides of 'A' turret. Most carried this on 'B' and 'X' turrets instead.

gained from recently launched dreadnoughts and battlecruisers, or following strong recommendations made by the Director of Naval Construction. The most visible difference was the shifting of the foremast, which now sat behind the bridge but immediately in front of the forward funnel. While smoke interference was still a problem, it was a considerable improvement on the arrangement in the Orion class. It also took the form of a light pole mast, rather than a heavier tripod arrangement.

Rear Admiral Moore, the new Director of Naval Ordnance, recommended increasing the secondary armament from 4-inch to 6-inch quick-firing guns to counter the growing threat posed by destroyers and torpedo boats. The Admiralty ignored this recommendation, as the larger weapons would add almost 2,000 tons to the displacement, and for political reasons they had already assured the government that these new ships would not be significantly larger or heavier than their predecessors. Above all, they could not be noticeably more expensive. However, these casemate guns were regrouped to provide an improved field of fire over the bow quarters, and they were provided with better protection than before.

The 13.5-inch guns of 'Q' turret on the *King George V* are trained to starboard, in line with 'X' and 'Y' turrets further aft, during a gunnery exercise conducted off Orkney during the winter of 1917–18. Under full fire control all her guns were angled so the shells would land in the same place.

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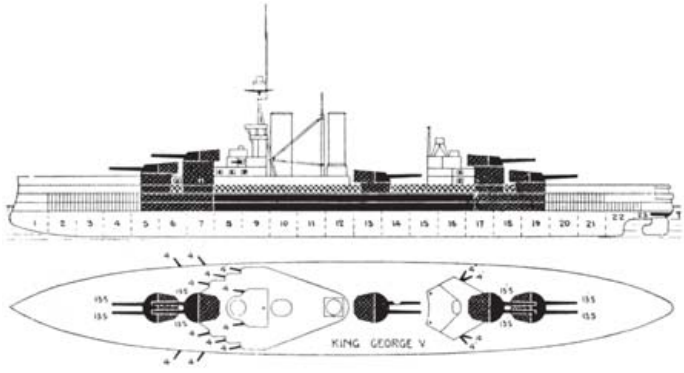
Other modifications were less visible. The 13.5-inch guns were adapted to fire a new and heavier 1,400-pound shell, which had a greater range than the previous 1,250-pound version. 'Q' turret was given a wider arc of fire, the fire control system was improved (which in turn permitted a smaller control top), and an armoured fire control position was fitted above the conning tower. The control top was subsequently enlarged before the outbreak of the war, which in turn necessitated the reinforcement of the foremast. The bridge itself was also modified to improve visibility and increase facilities for command and control.



The protection scheme of the King George V class was essentially the same as that of the Orions, although it was more complete, with additional anti-torpedo reinforcement running the length of the hull and a slight thickening of internal bulkhead protection.

While the same basic propulsion system was provided for both the Orion and the King George V classes, after experiments with a new and unsatisfactory design of propeller were abandoned, it was found that the engines of this new class generated more power. However, increases to beam, draught and displacement meant that both classes were only able to make 21 knots.

In terms of armoured protection the King George V-class ships were virtually identical to the Orion class, but internal protection was improved slightly, with thicker longitudinal bulkheads. These were still inadequate, however, as the sinking of the *Audacious* proved. After she struck a mine in October 1914 all watertight doors were closed, but water still passed through joints in the bulkheads and the ship was eventually lost. A more successful addition was the 3-inch protective plate built around the secondary armament, which offered significantly better protection to the gunners than in previous dreadnoughts.

The four ships of this class were 800 tons heavier than their predecessors of the Orion class, 16½ feet longer, and had a slightly wider beam.

The forecastle of the super dreadnought *King George V*, photographed during a visit to the fleet by the king shortly after the surrender of the German fleet. In this view the deflection scale on 'B' turret is clearly visible.

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The increased displacement also meant a slightly deeper draught, but generally their performance was similar to that of the earlier batch of super dreadnoughts. This in itself was something of a disappointment to the British public, who fully expected that Fisher's dictum that each would be better than before would continue to apply. This was largely due to the financial constraints imposed by a government that was concerned by the almost prohibitive costs of the dreadnought building programme, and was continually looking for ways to limit its naval expenditure.

The *King George V*, originally called the *Royal George* but renamed before her launch, was the first of the batch to be commissioned, and so became the namesake of her class. The remaining three followed during 1913, and together they formed the Home Fleet's 2nd Battle Squadron. These ships performed well, and while the sinking of *Audacious* proved wrong the journalist from the *Daily Telegraph* who described the King George V class as being 'practically unsinkable', they remained one of the principal backbones of the Grand Fleet throughout the war. Just as importantly, they provided the blueprint for the next batch of Iron Duke-class super dreadnoughts, a group that would incorporate many of the improvements which parsimony had prevented from being incorporated into the leviathans of the King George V class.

Ship	Builder	Laid Down	Launched	Completed	Fate
King George V	Portsmouth Dockyard	16 January 1911	9 October 1911	November 1912	Sold and broken up 1926
Centurion	Devonport Dockyard	16 January 1911	18 November 1911	May 1913	Scuttled, 1944
Audacious	Cammell Laird, Birkenhead, Merseyside	February 1911	14 September 1912	October 1913	Sunk by mine, 27 October 1914
Ajax	Scotts, Greenock, Clydeside	27 February 1911	21 March 1912	October 1913	Sold and broken up 1926

B

HMS *AUDACIOUS* (KING GEORGE V CLASS) AND HMS *MARLBOROUGH* (IRON DUKE CLASS)

While most dreadnoughts spent the war painted in a basic grey – the shade varying from time to time – a few were painted in experimental camouflage schemes. One of these was the King George V-class super dreadnought *Audacious* (top), which in September–October 1914 was painted in the experimental 'zebra pattern' scheme shown here. The scheme was soon abandoned, as it was felt such camouflage was inappropriate for the capital ships of the battle fleet. While camouflage experiments continued intermittently, it was not until the last year of the war that the idea was properly resurrected. *Audacious* was commissioned in October 1913 and joined the 2nd Battle Squadron. On 27 October 1914 *Audacious* struck a mine off Tory Island, off the north-western coast of Ireland. Although none of her crew was lost when she sank, this disaster was a serious blow to the fleet. *Audacious* would remain the only super dreadnought to be lost during the war. This small upper view shows her in September 1914 – she was repainted in the overall mid-grey shown in the main view in early October. The super dreadnoughts of the Iron Duke class were longer and heavier than their predecessors, and almost 100 feet longer than *Dreadnought*. They could be readily identified from previous super dreadnoughts by their thinner funnels and wider beam. *Marlborough* (bottom), the second ship of the class to enter service, is shown here as she appeared during the Battle of Jutland in May 1916. She was hit by a torpedo during the battle but she remained in the battle line, and went on to disable a German cruiser during the subsequent pursuit of the German fleet.

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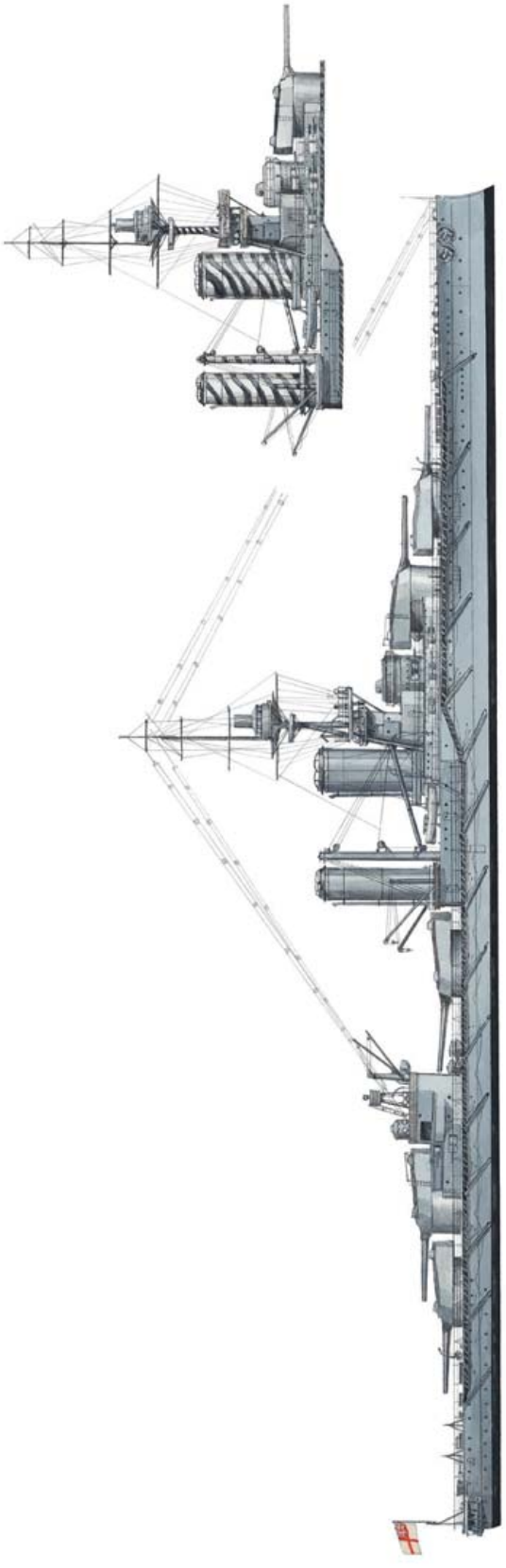

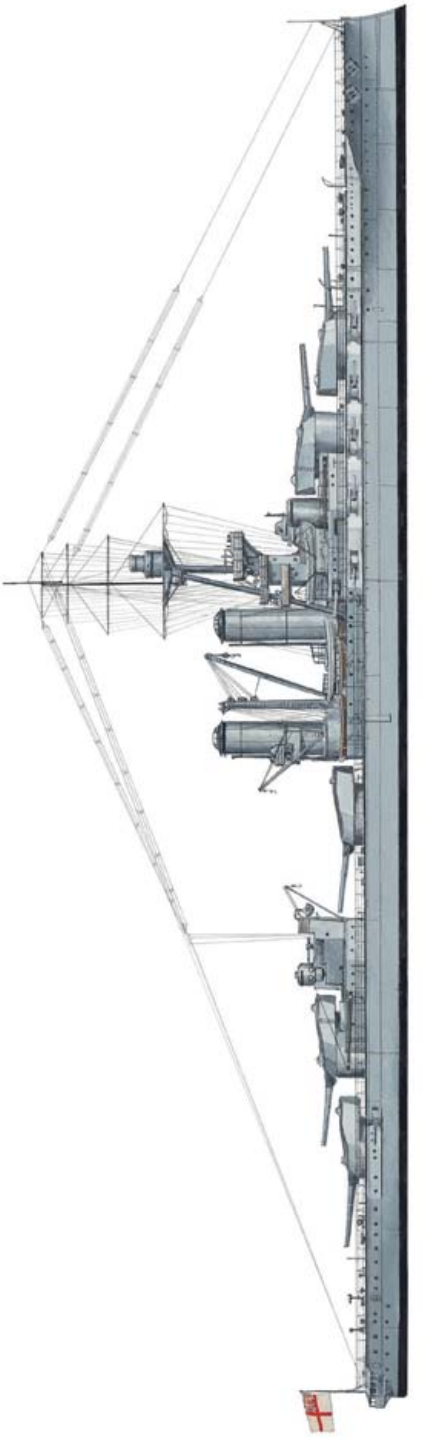

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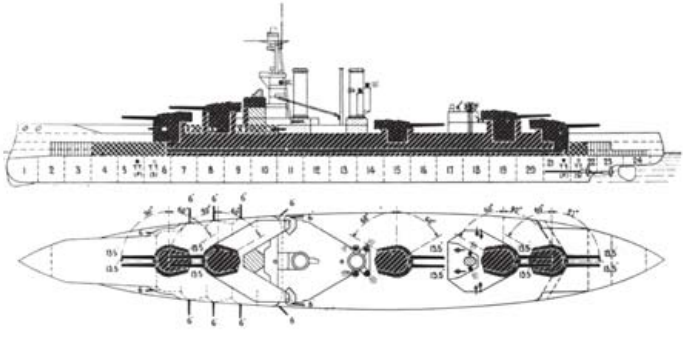
The *Iron Duke* as she appeared when she was first commissioned in March 1914. At the time she had just taken over from *Neptune* as the flagship of the Home Fleet, based in Portsmouth. She flies the flag of the fleet's commander, Admiral Callaghan.

Iron Duke Class

As was the case in previous years, the 1911 naval budget included funds for the building of four new super dreadnoughts, which were earmarked to be mproved and slightly enlarged versions of the King George V class. The main reason for making these ships larger than their predecessors was due to proposed changes in their secondary armament. From the initial *Dreadnought* onwards, the provision of secondary guns had been grudging. In *Dreadnought*, Fisher installed 12-pounder (76mm) pieces, which were considered adequate to ward off enemy torpedo boats.

Subsequent dreadnoughts and super dreadnoughts were fitted with larger and more powerful 4-inch 50 calibre quick-firing guns (QF), which were better suited to the task given the steady increase in the size and resilience of torpedo craft. In *Iron Duke*, the DNO had his way, and the 4-inch QFs were replaced by 6-inch guns, capable of taking on enemy cruisers acting as torpedo boat leaders. While some saw this as a dilution of the 'all big gun' concept of dreadnought design, in practical terms it was a sensible step, and made the Iron Dukes a better all-round capital ship than those that had come before. The fact that Admiral Fisher had retired in 1910 made it easier for the Admiralty to move away from his 'all big gun' doctrine.

The Iron Duke-class super dreadnoughts had a greater displacement than their Orion and King George V-class predecessors, and this necessitated a slightly different armoured belt as the ships had a deeper draught. Also, better deck protection was provided, as it was now felt that naval battles might be fought at a range where plunging fire would be a consideration.



The 6-inch guns were mainly grouped in a pair of batteries running below the level of the main deck on either side of the forward superstructure. These were scalloped out of the hull, and angled so that the first four guns on each side could fire forward, while the last one could only fire on the beam. Below 'Y' turret a final pair of guns was also mounted in scalloped recesses in the hull,

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During the war a number of dreadnoughts were fitted with the towing equipment needed to operate kite balloons. These anti-aircraft defences could be used both at sea and in harbour. Here *Marlborough* is pictured under way in Scapa Flow while recovering her tethered balloon.

and was capable of firing aft or over the beam. These 12 casemate guns were protected by 6 inches of armoured plate, a big improvement over the protection afforded to the secondary guns on all previous dreadnoughts.

The weakness of this configuration was that in anything other than perfect conditions, the wash of the ship and breaking water over the forecastle tended to enter these casemates, leaving the gunners soaked and working in what amounted to a paddling pool of standing water. The solution was to build small protective walls behind the guns to prevent water flowing into the ship, and to install rubber seals between the gun shields and the casemate embrasures. That did the trick. However, the aftermost pair of 6-inch guns flanking 'Y' turret proved useless in anything other than the calmest of conditions, and so in 1915 they were re-sited above the aftermost (fifth) casemate gun on each side, below the bridge. Unlike the others, these new 6-inch mountings were unarmoured.

The extra weight of the larger QF guns added almost 2,000 tons to the displacement, even though the Iron Dukes carried 12 rather than 16 secondary guns. They were also just over 25 feet longer than their predecessors, and this in turn added a foot to the beam in order to maintain the same approximate keel to beam ratio and level of buoyancy as previous dreadnoughts. This extra space proved very useful and led to further modifications. Most importantly, there was now plenty of space to fit the foremast well forward of the funnel, to reduce smoke interference to a minimum. The foremast was supported by a heavy tripod, in line with the latest rethinking of fire control methods, as it had to support a larger control top. The funnels themselves were much thinner than in previous dreadnoughts, and this gave the class a very distinctive, almost delicate look.

Other less visible changes included the extending of the main belt further aft, and the thinner extension of the belt further aft of the main section was thickened, as was the lower belt armour. However, the extremities of these belts were thinner than they had been in previous super dreadnoughts. The internal arrangement of longitudinal bulkheads was improved slightly, with extra bulkheads installed, although the thickness of some of these was less than those fitted to previous capital ships. One problem emerged after the ships entered service. If fully laden with coal and supplies, the thin main belt was almost submerged, so great care had to be taken to trim the ships appropriately.

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The Iron Duke-class super dreadnought *Benbow*, lying off Rosyth in the Firth of Forth during the closing weeks of the war. Note the deflection scales painted on 'B' and 'X' turrets and the enlarged black-painted control top. Unlike some of her sister ships, *Benbow* was not equipped with flying off platforms at this stage of the war.

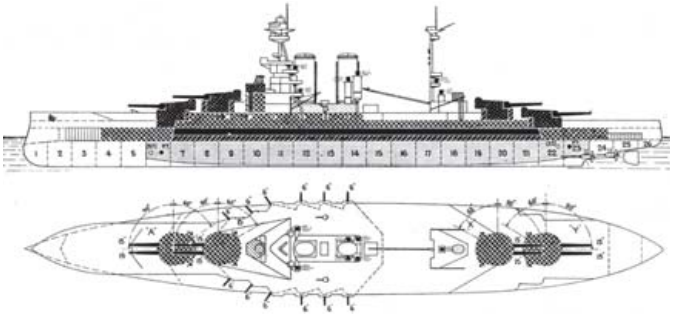
There was no significant improvement in the machinery provided to the Iron Dukes compared to the King George V class. The same paired sets of Parsons turbines were fitted along with an identical configuration of 18 boilers. The result was that these ships were capable of making 21 knots, which allowed them to keep up with the rest of the fleet, but nothing more. It would be another year before the Admiralty approved an upgrade in propulsive power that turned an adequate turn of speed into a highly impressive one.

Ship	Builder	Laid Down	Launched	Completed	Fate
Iron Duke	Portsmouth Dockyard	12 January 1912	12 October 1912	March 1914	Sold and broken up 1946
Marlborough	Devonport Dockyard	25 January 1912	24 October 1912	June 1914	Sold and broken up 1932
Benbow	Beardmore, Clydeside	30 May 1912	12 November 1913	October 1914	Sold and broken up 1931
Emperor of India	Vickers, Barrow-in-Furness	31 May 1912	27 November 1913	November 1914	Sunk as a target 1931

Queen Elizabeth Class

The 'fast battleships' of the Queen Elizabeth class had better armoured protection than any previous British capital ships, yet surprisingly they were also faster thanks to a greatly improved propulsion system. The armoured belt was well designed, and was considered capable of withstanding hits by 15-inch shells.

The capital ships that followed the original *Dreadnought* can all be seen as a sort of linear progression – a slow but steady improvement in power and substance in line with Fisher's 'each one better than the last' dictum. In some ways the pace of building had been more important than the finished product, and improvements and modifications came gradually. The sheer pace of building meant that from the Orion class entering service in 1912 and the ordering of the Iron Duke class, there was no time to evaluate the performance of the first super dreadnoughts. Any modifications based on experience of earlier classes had to be introduced as the latest ships were being built. Fortunately, Sir Philip Watts and his team of naval constructors seemed to have a knack for delivering ships that were consistently better than the ones that had preceded them without any empirical knowledge to help them. In short, each new class represented something of a leap of faith.



Sir Philip Watts truly surpassed himself in the last class he supervised before his retirement in 1912, when the mantle of Director of Naval Construction was taken over by Eustace Tennyson d'Eyncourt. The late Teddy Archibald said of the Queen Elizabeths:

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Just occasionally a ship is designed and built which, taken overall, is of such essential rightness that she must forever be remembered as the classic of her type. Such a one was the *Queen Elizabeth*, the name ship of her class of five. It does not matter that ships were to be built later which surpassed her in firepower, protection and speed. What matters is that in the context of her time, the First World War, she represented the ultimate expression of the Dreadnought type, with beautifully balanced graceful profile, superior speed, superior armament and protection. It was fitting that the Queen Elizabeths should be Watt's last class of battleship.

The Queen Elizabeth-class 'fast battleship' *Malaya* pictured from the air during the surrender of the German fleet in November 1918. This perspective shows how 'B' and 'X' turrets had been fitted with flying off platforms, but these were subsequently removed.

Arguably, they were designed to fight a new kind of battle. Naval experts had fought for the creation of a new, faster kind of battleship, capable of racing ahead of the main fleet and pinning the head of an enemy battle line with fire. Admiral Togo had done exactly this at the Battle of Tsushima (1905), and advocates of the idea in the Royal Navy managed to convince the Admiralty that the battleships earmarked by the 1912 naval budget should be 'fast battleships' capable of fulfilling this role. Of course, Sir Philip Watts had already argued for faster battleships, but his suggestions had consistently been ignored by the Admiralty, who were constrained by both budget and time. This time the Admiralty heeded his advice.

While the notion of the 'fast battleship' and the design and construction of Queen Elizabeth and Royal Sovereign class capital ships is described in detail in NVG 154 *British Battleships 1939–45 (1)*, it is worth adding a few more comments here. First of all, the original intention was to produce a very different type of ship. The original plan had been to produce modified versions of the Iron Duke class, with 13.5-inch guns but with far more propulsive power. Reports that the Americans, the Japanese and possibly the Germans were opting for 14-inch gun designs prompted a rethink in the Admiralty, and so the DNO Rear Admiral Moore was asked to evaluate other options. The Elswick Ordnance Factory had already designed 14-inch guns for the Chilean Navy. The company was also experimenting with 15-inch guns, and it assured both the DNO and the DNC that these would be completed in time to fit in any new class of dreadnought. Encouraged by the new First Lord of the Admiralty, Winston Churchill, the Admiralty approved the switch to the larger calibre of gun.

The namesake of her class, the 'fast battleship' *Queen Elizabeth* is pictured moored in the Firth of Forth during the winter of 1917–18. She is lying off Rosyth in the lee of the Forth Rail Bridge, which can be seen behind her.

As for the ships themselves, Sir Philip Watts submitted three designs, working on the assumption that what was

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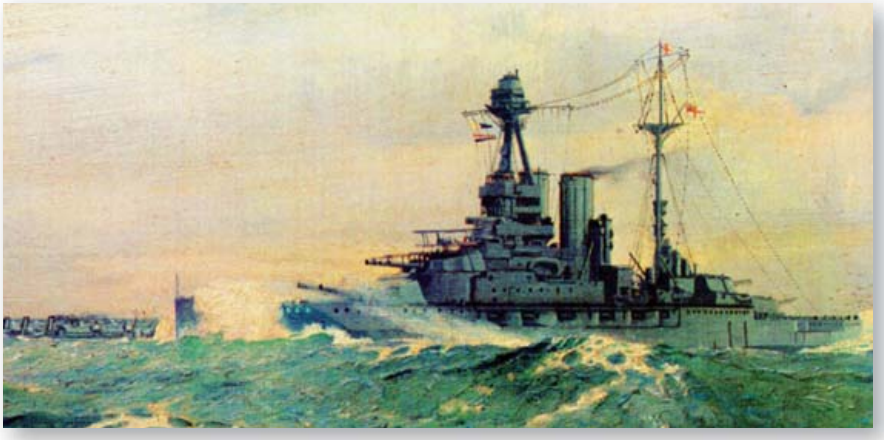
A 'fast battleship' of the Queen Elizabeth class, painted during a sweep of the North Sea in late 1917. Given the presence of the flying off platform, it is likely that the ship represented here is either *Warspite* or *Barham*.



needed was a dreadnought capable of making 25 knots, but with the maximum possible level of firepower and a level of armoured protection commensurate with the latest super dreadnoughts then under construction. Each varied slightly in terms of turret placement and the number of internal bulkheads. One version known as 'RIV' even had 'X' turret mounted at deck level rather than superimposed, which left only one turret capable of firing astern. The design which the Admiralty finally approved was known as 'RIII*', which called for a vessel of 27,000 tons, armed with eight '14-inch experimental' guns, and a secondary battery of 6-inch quick firers.

In fact these experimental guns were actually 15-inch pieces mounted in four twin turrets. While this meant they carried eight instead of ten guns apiece, the larger shell weight and the weight saving made by not fitting a 'Q' turret more than compensated for the smaller main battery. The Queen Elizabeths fired a broadside weight of 15,000 pounds, compared to the 14,000-ton broadside of the Iron Dukes. The original intention had been to mount five twin turrets, arranged in the same way as the Iron Duke. However, this idea was abandoned when it was proved that this would unduly affect the ratio of hull size, propulsive power and displacement. Given the superior firepower of the four-turret configuration and the huge increase

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HMS *WARSPITE* (QUEEN ELIZABETH CLASS) AND HMS *RESOLUTION* (ROYAL SOVEREIGN CLASS)

The ultimate expressions of the dreadnought concept, the 'fast battleships' of the Queen Elizabeth class, were the best all-round capital ships of the war. Indeed, they continued to prove their worth until the end of World War II. When they entered service they were faster, better protected and carried a heavier armament that any other capital ships in the world. Their horsepower was more than double that of the Iron Duke class, and their 15-inch guns gave them the significant edge over almost all of their German rivals. *Warspite* (top) is probably the most famous ship in the class, largely thanks to her exploits in World War II. However, she also saw action at Jutland, firing 259 shells and receiving 11 hits in return. She is shown here as she appeared at Jutland. The Royal Sovereign-class ships (sometimes called the Revenge class) were effectively cheaper versions of the Queen Elizabeth class, although in appearance they had more in common with the Iron Dukes. *Resolution* (bottom) was commissioned after Jutland, and so she never fired her guns in anger before the war ended. Like many dreadnoughts she was fitted with 'flying off' platforms during the last year of the war, as it was felt that aircraft would improve the scouting ability of the fleet. In practice, however, it proved difficult to launch aircraft from these platforms in anything other than the calmest of seas. The detail shows a Sopwith 1½ Strutter preparing to take off from 'B' turret.

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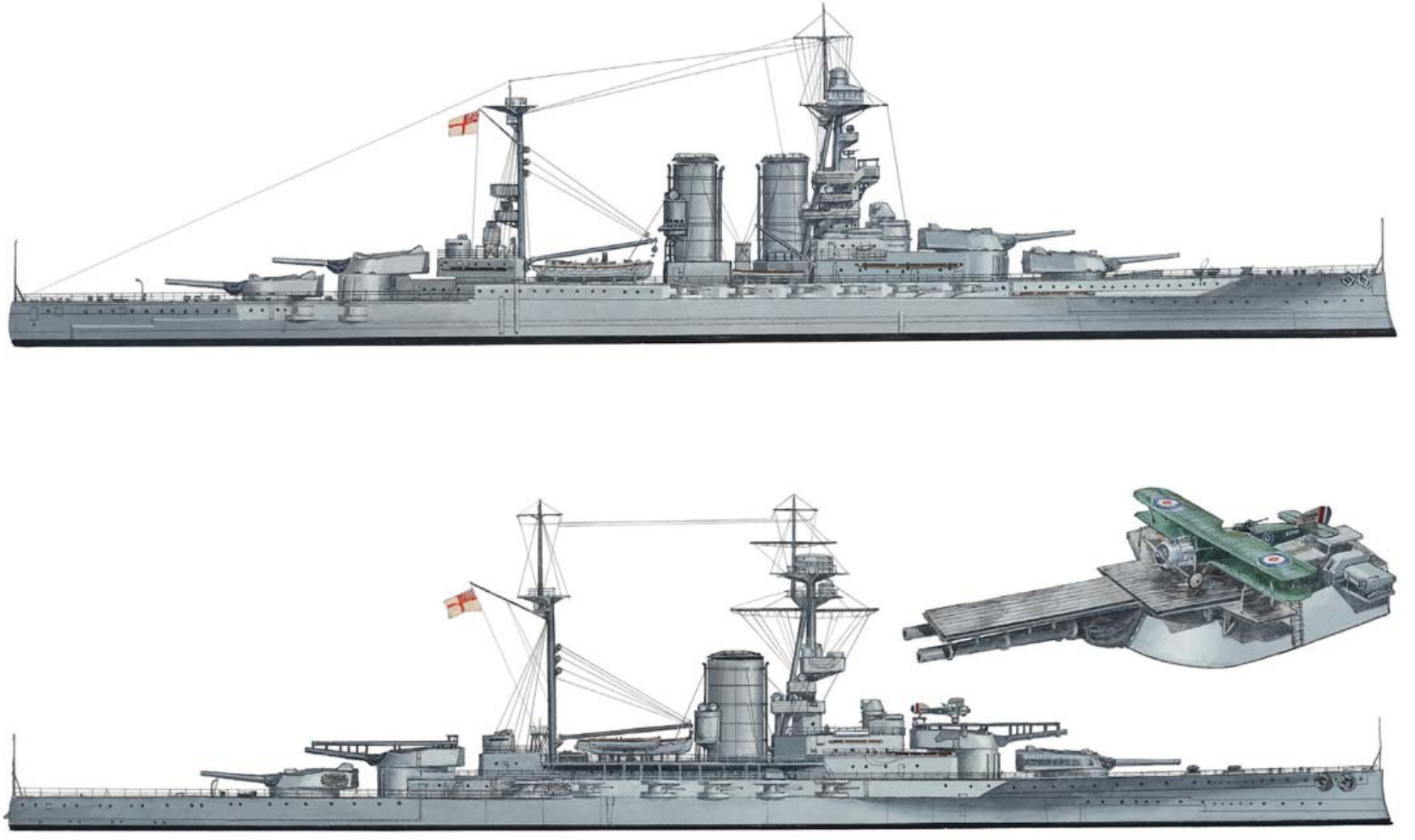

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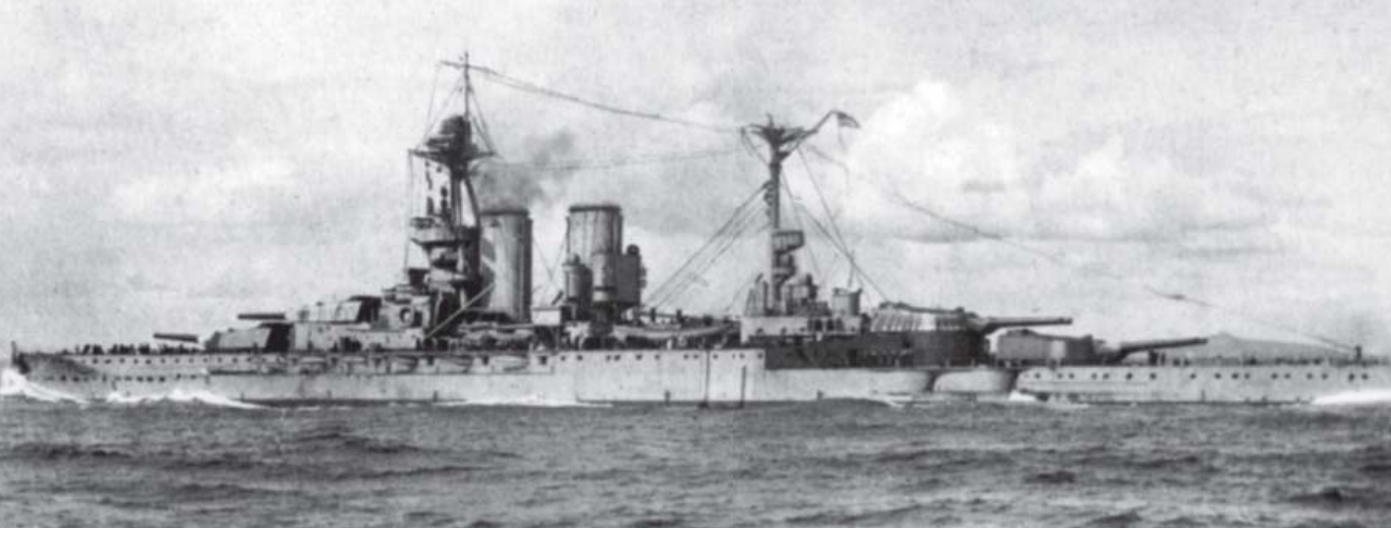

The Queen Elizabeth-class 'fast battleship' *Valiant* photographed at sea during the closing months of the war. Like all of her sister ships apart from *Queen Elizabeth*, *Valiant* had been fitted with flying off platforms, but these were removed on *Valiant* and *Barham* during the summer of 1918.

in destructive power compared to the weight of broadside, the Admiralty voted unanimously to approve Sir Philip's recommended design.

The biggest concern of the Admiralty was not whether the ships could be built to their specifications but whether the new 15-inch gun would work. Designing a ship around a gun that had not been tested flew in the face of both common sense and convention. They need not have worried, however, as thanks to the work of the DNO and the team at Elswick the performance of the 15-inch Mark I breech-loading gun exceeded all expectations and set a new benchmark for battleship armament. The fact that the Queen Elizabeths were still in service over three decades later is a testimony to the effectiveness of their guns.

As in the Iron Duke class, these 'fast battleships' were also fitted with a secondary armament of 6-inch guns. According to the original design 16 secondary guns were to be fitted – four more than in the Iron Dukes – and like the previous class these would be mounted in casemates mounted in the hull, immediately below the upper deck. Three on each side were angled to face forward as well as to the beam, firing along scalloped cut-outs in the forward hull. Three more on each side were facing each beam abreast of the funnels. Finally, two more pairs were mounted towards the stern in scalloped recesses on either side of 'Y' turret. However, as in the Iron Duke class, it was soon found that these stern casemates were impractical as they were too close to the waterline. In the end they were only fitted to the *Queen Elizabeth*, and even then they were removed in May 1915. The other ships of the class never had them fitted – instead they were replaced by a single pair of guns mounted on the main deck abreast of the after funnel.

Apart from the guns, the big innovation with the Queen Elizabeth class was the machinery. Mixed coal- and oil-fired systems were rejected, and so these ships became the first pure oil-firing capital ships in the fleet. Like the main armament, this represented another leap in the dark, as this form of system had never been tested in such large ships. The advantages, though, clearly outweighed everything else. Using oil-fired engines these ships would be able to accelerate quickly, they would find it easier to maintain high speeds for a long period, and they would be easier to refuel. As a final bonus, the lack of coal smoke meant that they would also be harder to see, and so would be more likely to sneak up on an enemy battle fleet unawares.

Propulsion was provided by two groups of turbines, divided by longitudinal bulkheads to reduce the risk of the loss of power through

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flooding. These were fired by 24 high-pressure boilers generating an impressive 56,000 steam horsepower (shp), which compared very favourably with the 29,000 shp of the Iron Dukes. This gave an official top speed of 23 knots, but if pushed these 'fast battleships' could risk overloading their engines and make 25 knots for short periods. As 'fast battleships' they lived up to their name.

While the original budget called for three ships, four Queen Elizabeths were eventually ordered, followed by a fifth – *Malaya* – which was paid for by the Federated Malay States. A sixth ship had been planned, to be built in Portsmouth as soon as the royal dockyard there had completed the *Queen Elizabeth*. She was to be called the *Agincourt*, but when the war began she was cancelled, and the name given to the dreadnought *Sultan Osman I*, which had been built for the Turkish Navy and was impounded when Turkey entered the war on the side of Germany. Only two of the remaining five ships had been launched before the outbreak of war in August 1914, but all of them entered service before Jutland.

Ship	Builder	Laid Down	Launched	Completed	Fate
Queen Elizabeth	Portsmouth Dockyard	21 October 1912	16 October 1913	December 1914	Sold and broken up 1948
Warspite	Devonport Dockyard	31 October 1912	26 November 1913	March 1915	Sold and broken up 1946
Valiant	Fairfield, Clydeside	31 January 1913	4 November 1914	February 1916	Sold 1946, wrecked 1947
Barham	John Brown, Clydeside	24 February 1913	31 October 1914	October 1915	Torpedoed and sunk 25 November 1941
Malaya	Armstrong, Tyneside	20 October 1913	18 March 1915	February 1916	Sold and broken up 1948

Royal Sovereign Class

In 1912 Sir Philip Watts retired as the Director of Naval Construction, although he remained in the Admiralty in an advisory capacity. His place was taken by Eustace Tennyson d'Eyncourt, whose first task after supervising the completion of the warships then under construction was to design a new class of capital ships, to be built from 1913 onwards if the financing of them was approved in the 1913 budget. His brief from the Admiralty was to come up with a plan for a new super dreadnought, based on the lines of the Iron Duke class but carrying the 15-inch guns used in the Queen Elizabeths. This type of ship had been considered in 1911, but had been rejected in favour of the 'fast battleship' design. Now that need had been met, the Admiralty felt these new ships did not need the speed of the previous class; instead, a top speed of 21 knots was considered more than enough to keep pace with the rest of the battle fleet.

D'Eyncourt considered several options, including mounting guns in three triple turrets, a configuration he would later use in the Nelson class. He revisited the idea of a ten 15-inch gun ship, but as he felt the five turrets would cause too great an increase in size and displacement he developed a four-turret version with two double and two triple turrets,

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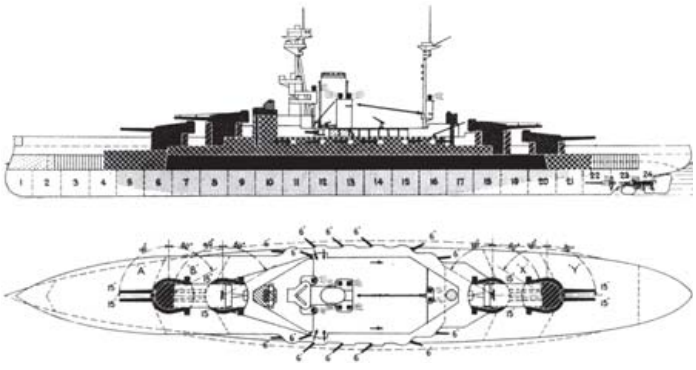

While the dreadnoughts of the Royal Sovereign class have been described as cut-price Queen Elizabeths, their powerful armament made them useful additions to the fleet. Moreover, their armour was concentrated where it was needed most, above the waterline and in the barbettes and turrets.

the smaller ones superimposed over the larger mountings. The notion was abandoned due to the lengthy delay needed to carry out the experimental work needed before such a radical design could be properly considered. That left him with an eight-gun configuration in four twin turrets. This would still give these new ships a weight of broadside that was greater than the vessels of the Iron Duke class.

In March 1913 the Admiralty approved d'Eyncourt's 'T1' design, which called for a 25,750-ton ship, with a length and beam that were slightly smaller than those of the Iron Duke class. In addition to their main armament these ships would carry a secondary battery of 14 6-inch guns, with their placement mirroring the Queen Elizabeth class. Critics have described these ships as 'cut price Queen Elizabeths', but this is unfair as d'Eyncourt was not ordered to model these ships on the previous batch of 'fast battleships'. Instead, the four ships of the 1913 programme should be seen as '15-inch Iron Dukes'. Collectively they would become the Royal Sovereign class, sometimes referred to as the Revenge class.

The ships of the Royal Sovereign class were certainly different from their 15-inch gun predecessors. They displaced 1,750 fewer tons than the Queen Elizabeth class and were 20 feet shorter, with a correspondingly narrower beam. While the main batteries of both classes were identical, the secondary guns of the Royal Sovereigns were better placed for all-round fire than those on the Queen Elizabeth-class ships. The main armoured belt was less tapered, and therefore the ships were slightly better protected against hits to the hull. It also extended all the way to the stem and stern, although by then the protective value was minimal as the armour was just 1 inch thick at the extremities.

More noticeably, these ships were slower than their predecessors, and used a mixed oil and coal arrangement, which had proved less efficient than the revolutionary all oil-fired machinery of the Queen Elizabeth class. In retrospect the decision to make these ships operate using coal was a mistake, but at the time this was an important political consideration. Great Britain produced its own coal, while stocks of oil had to be imported from overseas. A coal-fired ship was therefore considered to be less reliant on the vagaries of Middle Eastern supplies.

One striking feature of the Royal Sovereign class compared to earlier capital ships was the degree of underwater protection they enjoyed. Experiments had revealed that if a protective barrier was placed outside the hull below the waterline, then the effect of a torpedo hit would be significantly reduced. In 1915, while the ships were still under construction, d'Eyncourt ordered *Ramillies* to be fitted with these 'torpedo bulges'. Sea trials showed that these did not significantly impair the performance of the vessel, and so *Revenge* and *Resolution* had a torpedo bulge added during 1917–18. The fourth ship in the class, *Royal Oak*, was only fitted with one after the end of the war. It is worth noting that the torpedo bulge fitted to *Royal Oak* did little to impede the torpedoing of her in October 1939.

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Ship	Builder	Laid Down	Launched	Completed	Fate
Ramillies	Beardmore, Clydeside	12 November 1913	12 September 1916	September 1917	Sold and broken up 1948
Resolution	Palmers, Tyneside	29 November 1913	14 January 1915	December 1916	Sold and broken up 1948
Revenge	Vickers, Barrow-in-Furness	22 December 1913	29May 1915	March 1916	Sold and broken up 1948
Royal Oak	Devonport Dockyard	15 January 1914	17 November 1914	May 1916	Torpedoed and sunk 14 October 1939
Royal Sovereign	Portsmouth Dockyard	15 January 1914	29 April 1915	May 1916	Sold and broken up 1949

HMS *Erin*

In 1911, the Turkish government ordered two identical dreadnoughts to be built in the private British shipyards of Armstrong and Vickers. One of these was soon cancelled due to Turkish budget problems in the wake of the First Balkan War (1912–13), but work on the *Reshad V* continued apace in the Vickers yard in Barrow-in-Furness. Another dreadnought, the *Sultan Osman I*, was also being built by Armstrong in Tyneside, having been bought from the Brazilian government while still under construction. A fourth dreadnought, a slightly larger version of the *Reshad V*, was ordered shortly before the outbreak of war, but work on her was cancelled before it had begun. In 1913 the *Reshad V* had her name changed to the *Reshadieh*.

In theory the *Reshad V*/*Reshadieh* was based on the British Orion class, but her hull was shorter and beamier than her British counterparts. She was designed by Vickers' chief naval architect Sir Richard Thurston, but elements of her design were subcontracted to the Armstrong yard, and to the John Brown shipyard in Glasgow's Clydeside. Work began on her in August 1911, and she was launched by the Turkish ambassador in September 1913. In line with the Muslim stance on alcohol, a bottle of rose water was broken over her bow rather than the usual bottle of champagne.

One of two dreadnoughts that were seized from the Turkish navy at the outbreak of war, the *Reshadieh* was a shorter and beamier version of the Orion class of super dreadnought. On entering British service she was renamed *Erin*.

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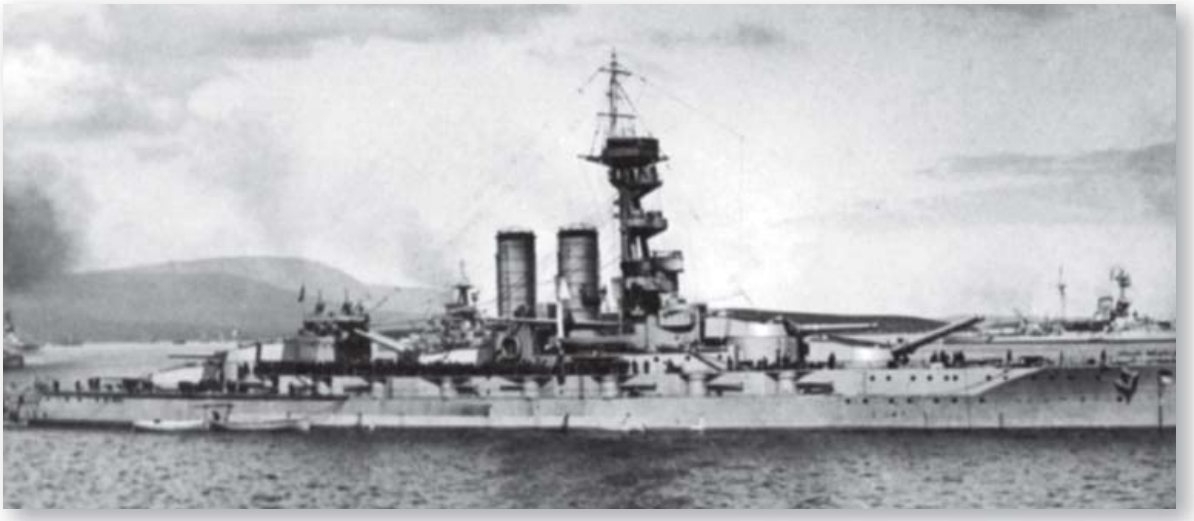
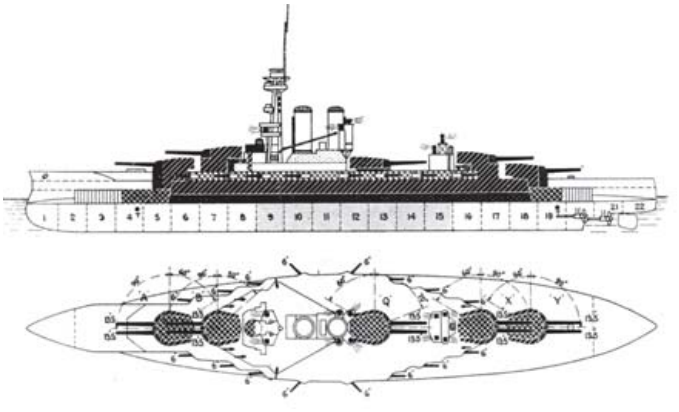


In this view of *Erin* lying at anchor off Flotta in Scapa Flow during the spring of 1917, a Royal Sovereign-class super dreadnought can be seen in the background. After Jutland *Erin* had her control top enlarged, her topmast reduced and extra anti-aircraft armament added.

The Turkish ship was better armed than her Orion class contemporaries, as in addition to her ten 13.5-inch 'Vickers Special' main guns she carried a secondary armament of 6-inch rather than 4-inch quick firers, mounted in sponsons set into casemates in the hull just below the main deck. Like the 6-inch guns of the Iron Duke class, the quick firers forward of the bridge were mounted in scalloped recesses in the hull, allowing three guns on each side to fire forward as well as out on the beam. Similarly, the after two gun mounts on each side were sited so they could fire astern, firing over the quarterdeck. This meant that her armament was on a par with the Iron Duke ships. One noticeable difference, however, was that 'Q' turret was mounted a deck higher than in the British super dreadnoughts, due to the need to create deck space for the secondary battery.

Her armoured protection compared favourably with her British counterparts, and when completed its configuration had more in kin with the King George V class than the Orions. In terms of her machinery she carried fewer boilers than her British contemporaries, but the *Reshadieh* could maintain a similar speed thanks to her shorter hull and modest displacement. This short hull had the added advantage that she was slightly more manoeuvrable than her British counterparts.

Given the fact that she was designed by Vickers rather than the Admiralty, the armour of *Erin* was surprisingly similar to other British super dreadnoughts, but she had thinner protective bands towards the bow and the stern than these other vessels.



When the war broke out in August 1914 work on the *Reshadieh* was halted, and when Turkey allied herself with Germany the vessel was seized by the British government. She was duly handed over to the Royal Navy, who renamed her *Erin*. Before she entered service with the fleet she was modified slightly. Her tripod mainmast was removed, while her internal compartments were altered to conform to the moderately better standards of accommodation afforded to British sailors. Still, her accommodation was considered cramped in comparison to other super dreadnoughts.

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Erin had a distinctive appearance. Her single mast gave her a slightly unbalanced appearance, accentuated by her high profile amidships. Her round ribbed funnels were also unique in the fleet, as was her bow, which was in the words of her first captain 'curved like a Turkish scimitar'. Erin joined the Grand Fleet in September 1914, less than two weeks after she had been taken into service, and served in the main battle fleet throughout the war.

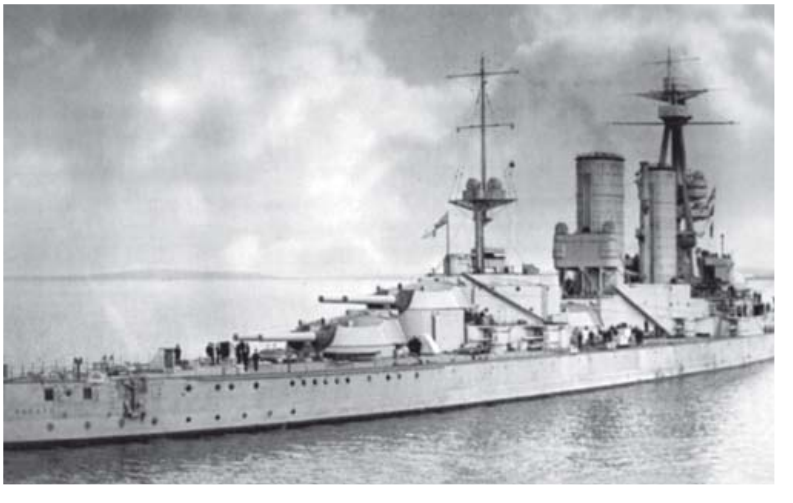
Ship	Builder	Laid Down	Launched	Completed	Fate
Erin	Vickers, Barrow-in-Furness	1 August 1911	3 September 1913	August 1914	Sold and broken up 1922

HMS *Canada*

Like *Erin*, *Canada* was designed privately and bought into service after the outbreak of war. She was one of several dreadnoughts ordered by South American governments, the first two being the *Minais Gerais* and *Sao Paulo*, built by Armstrong and Vickers respectively for the Brazilian Navy. Both of these 12-inch gun dreadnoughts were completed in 1910. The Brazilians then ordered an even larger 12-inch dreadnought, the *Rio de Janeiro*, a vessel that was sold to the Turks in 1914 and that eventually became *Agincourt*. In response to this, and to the building of two dreadnoughts in US yards by Argentina, the Chilean government decided to order two dreadnoughts of their own.

These vessels were to be the *Almirante Latorre* and the *Almirante Cochrane*, and both were to be built in the Armstrong shipyard in Tyneside. However, because one of the yard's two major stocks was occupied by the Brazilian *Rio de Janeiro*, work on the *Almirante Latorre* began in December 1911 but work on the second Chilean dreadnought was postponed until after the launch of the Brazilian ship in January 1913. The specifications for these two capital ships called for vessels of 27,400 tons, armed with ten 14-inch guns. This unusual weapon was designed by the Elswick works, as were the 12-inch guns earmarked for the *Rio de Janeiro*, and both shared several features that were not found in ordnance designed specifically for the Royal Navy. The 14-inch 'Armstrong Special' had a performance comparable with the 13.5-inch guns of the British super dreadnoughts, but its shells packed a slightly greater punch in terms of penetration and destructive power.

Unlike many of these British vessels, the Chilean super dreadnought was equipped with a secondary battery of 6-inch guns. The original Chilean specifications had been for 4.7-inch weapons, but they upgraded the armament in response to similar weaponry being fitted to the Brazilian *Rio de Janeiro*. These guns were



The only dreadnought designed to carry 14-inch guns, *Canada* was built for the Chilean government and was purchased from them before her completion in 1915. Here she is shown at anchor in Scapa Flow after joining the Grand Fleet.

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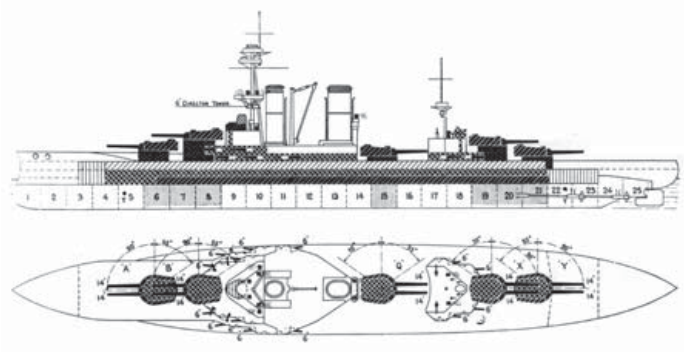

When it came to armour, *Canada* was the maverick of the dreadnought fleet as she lacked the protection afforded to Admiralty-designed super dreadnoughts. Most of her belt was also submerged, which meant enemy shells were more likely to hit her less well-protected upper belt.

mounted on sponsons housed in casemates, four on each beam mounted in the hull abaft of the forward superstructure, and three more located above them in the superstructure itself. Of these guns, four on each side were able to fire forward, either by firing over the forecastle or by way of scalloped recesses in the hull. Two more pairs of 6-inch guns were mounted on either side of the after superstructure.

The *Almirante Latorre* was launched in November 1913, by which time work on her sister ship *Almirante Cochrane* was already under way. Work on this second vessel was temporarily suspended when the war began. In line with a government ruling that foreign vessels under construction should be either seized or purchased, both vessels were duly bought from the Chilean government in early September. The *Almirante Latorre* was renamed *Canada*, and she was completed in September 1915. Her sister ship was eventually completed as the aircraft carrier *Eagle*.

Canada underwent a few very minor modifications before she entered service with the Grand Fleet in October 1916, but essentially she remained unaltered. One of her most impressive features was her speed. She was designed as a 'fast battleship', as the Chileans had specified they wanted their two super dreadnoughts to be faster than their Brazilian rivals. Therefore the *Canada* had a top speed of just under 23 knots, making her one of the fastest battleships in the Grand Fleet. She proved a very useful addition to the battle fleet, although she only once managed to fire her novel guns in anger, at the Battle of Jutland.

Ship	Builder	Laid Down	Launched	Completed	Fate
Canada	Armstrong, Tyneside	December 1911	27 November 1913	September 1915	Returned to Chile 1920; sold and broken up 1959

D

HMS *ERIN* AND HMS *CANADA*

When the war began in August 1914, two dreadnoughts were nearing completion in British shipyards, which were destined for service with the Turkish navy. Both of them were seized by order of the Admiralty. The 12-inch gun dreadnought *Sultan Osman I* duly became the *Agincourt*, while the *Reshadieh*, armed with ten 13½-inch guns, was duly incorporated into the fleet as the super dreadnought *Erin* (top). The ship had been designed by Vickers, and while she resembled the King George V class, there were notable differences. Most noticeable was the arrangement of her funnels, but also 'Q' turret was mounted a deck higher than in the British super dreadnoughts, and her hull was shorter and beamier. The *Erin* joined the 2nd Battle Squadron and fought at Jutland. The *Canada* was one of two super dreadnoughts that had been ordered from Armstrong by the Chilean navy. She was originally called the *Almirante Latorre*, but when the war began the Chileans agreed to sell their battleship to Britain, and so she duly became the *Canada* (bottom). Her sister ship *Almirante Cochrane* was eventually converted into the aircraft carrier *Eagle*. The only British battleship of the war to carry 14-inch guns, *Canada* served with the 4th Battle Squadron and fought at Jutland. Both of the super dreadnoughts in this plate are shown as they would have looked during the battle.

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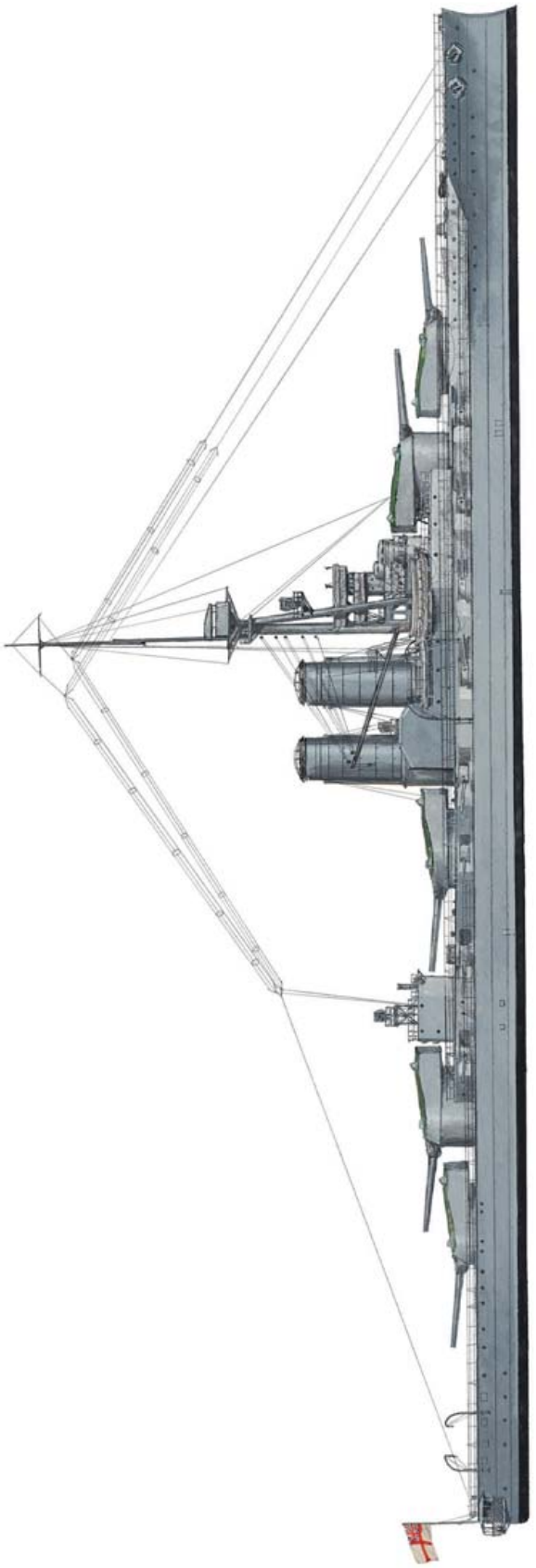

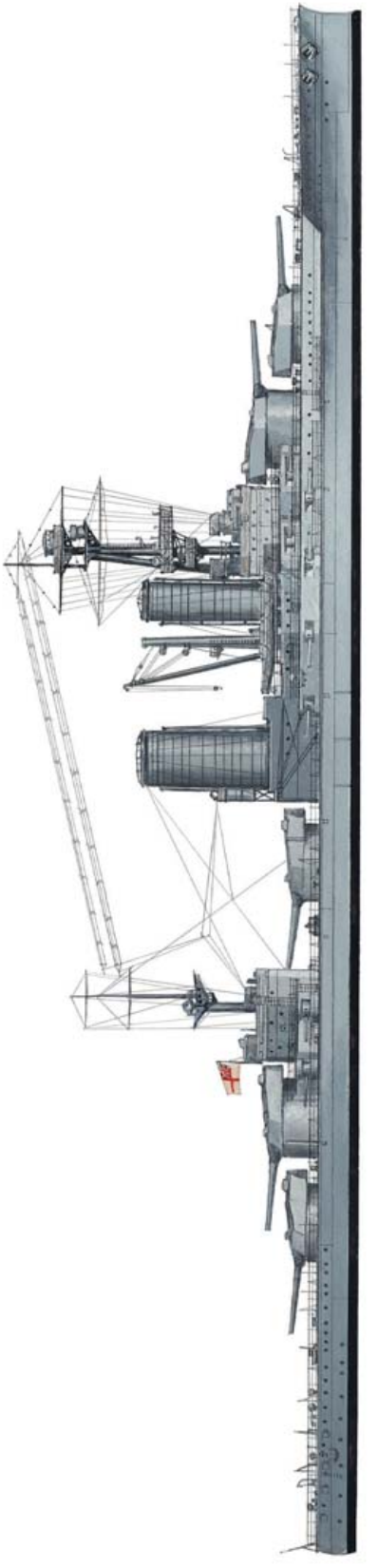

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SPECIFICATIONS

Orion Class	
Length	581 feet overall
Beam	88 feet 6 inches
Draught	24 feet 11 inches (mean lading)
Displacement	22,200 tons (25,870 tons fully laden)
Propulsion	Parsons steam turbines, 18 Babcock and Wilcox boilers (Yarrow boilers in *Monarch*), generating 27,000 steam horsepower (shp)
Maximum speed	21 knots
Range	6,730 nautical miles at 10 knots
Armament	Ten 13.5-inch Mark V BL guns in five twin turrets
	16 4-inch QF guns in single mounts
	Four 3-pdr saluting guns in single mounts
	Three submerged torpedo tubes, carrying 21-inch torpedoes
Protection	Belt: 8–12 inches
	Bulkheads and barbettes: 3–10 inches
	Turret faces and conning tower: 11 inches
	Deck: 1–4 inches
Complement	752 officers and men

King George V Class	
Length	597 feet 6 inches overall
Beam	89 feet
Draught	28 feet 8 inches (mean lading)
Displacement	23,000 tons (25,700 tons fully laden)
Propulsion	Parsons steam turbines, 18 Babcock and Wilcox boilers (Yarrow boilers in *Audacious* and *Centurion*), generating 31,000 shp
Maximum speed	21 knots
Range	6,730 nautical miles at 10 knots
Armament	Ten 13.5-inch Mark V BL guns in five twin turrets
	16 4-inch QF guns in single mounts
	Four 3-pdr saluting guns in single mounts
	Three submerged torpedo tubes, carrying 21-inch torpedoes
Protection	Belt: 8–12 inches
	Bulkheads: 4–12 inches
	Barbettes: 3–10 inches
	Turret faces and conning tower: 11 inches
	Deck: 1–4 inches
Complement	782 officers and men

Iron Duke Class	
Length	622 feet 9 inches overall
Beam	90 feet
Draught	29 feet 6 inches (mean lading)
Displacement	25,000 tons (29,560 tons fully laden)
Propulsion	Parsons steam turbines, 18 Babcock and Wilcox or Yarrow boilers, generating 29,000 shp
Maximum speed	21¼ knots
Range	7,780 nautical miles at 10 knots

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The Iron Duke-class super dreadnought *Emperor of India*, pictured at the start of the war. As happened with other ships of her class, in late 1915 her after 6-inch guns were remounted in casemates on her forecastle deck, below the forward funnel.

Armament	Ten 13.5-inch Mark V BL guns in five twin turrets
	12 6-inch Mark VII BL guns in single mounts
	Two 3-inch Mark I anti-aircraft guns in single mounts
	Four 3-pdr saluting guns in single mounts
	Four submerged torpedo tubes, carrying 21-inch torpedoes
Protection	Belt: 4–12 inches
	Bulkheads: 1½–8 inches
	Barbettes: 3–10 inches
	Turret faces and conning tower: 11 inches
	Deck: 1–2½ inches
Complement	718 officers and men

Queen Elizabeth Class	
Length	645 feet 9 inches overall
Beam	90 feet 6 inches
Draught	28 feet 9 inches (mean lading)
Displacement	27,500 tons (31,500 tons fully laden)
Propulsion	Parsons steam turbines (Brown Curtis turbines in *Barham* and *Valiant*), 24 Babcock and Wilson boilers (Yarrow boilers in *Barham* and *Valiant*), generating 56,000 shp
Maximum speed	23 knots
Range	4,500 nautical miles at 10 knots
Armament	Eight 15-inch Mark I BL guns in four twin turrets
	14 6-inch Mark XII BL guns (16 guns in *Queen Elizabeth*) in single mounts
	Two 3-inch Mark I anti-aircraft guns in single mounts
	Four 3-pdr saluting guns in single mounts
	Four submerged torpedo tubes, carrying 21-inch torpedoes
Protection	Belt: 4–14 inches
	Bulkheads: 4–6 inches
	Barbettes: 4–10 inches
	Turret faces: 13 inches
	Conning tower: 11 inches
	Deck: 1–3 inches
Complement	925–951 officers and men

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Royal Sovereign Class	
Length	624 feet 3 inches overall
Beam	88 feet 6 inches
Draught	28 feet 6 inches (mean lading)
Displacement	28,000 tons (31,000 tons fully laden)
Propulsion	Parsons steam turbines, 18 Babcock and Wilcox or Yarrow boilers generating 40,000 shp
Maximum speed	23 knots
Range	4,200 nautical miles at 10 knots
Armament	Eight 15-inch Mark I BL guns in four twin turrets 14 6-inch Mark XII BL guns in single mounts Two 3-inch Mark I anti-aircraft guns in single mounts Four 3-pdr saluting guns in single mounts Four submerged torpedo tubes, carrying 21-inch torpedoes
Protection	Belt: 1–13 inches Bulkheads: 4–6 inches Barbettes: 4–10 inches Turret faces: 13 inches Conning tower: 11 inches Deck: 1–2 inches
Complement	908–997 officers and men

HMS *Erin*	
Length	559 feet 6 inches overall
Beam	91 feet 7 inches
Draught	28 feet 5 inches (mean lading)
Displacement	22,780 tons (25,250 tons fully laden)
Propulsion	Parsons steam turbines, 15 Babcock and Wilcox boilers, generating 26,500 shp
Maximum speed	21 knots
Range	5,300 nautical miles at 10 knots
Armament	Ten 13.5-inch Mark V BL guns in five twin turrets 16 6-inch Mark XI BL guns in single mounts Two 3-inch Mark I AA guns in single mounts Six 6-pounder (57mm) signalling guns, in single mounts Four submerged torpedo tubes, carrying 21-inch torpedoes
Protection	Belt: 4–12 inches Bulkheads: 4–8 inches Barbettes: 3–10 inches Turret faces: 11 inches Conning tower: 12 inches Deck: 1½–3 inches
Complement	1,070 officers and men

HMS *Canada*	
Length	661 feet overall
Beam	92 feet
Draught	29 feet (mean lading)
Displacement	28,600 tons (32,120 tons fully laden)
Propulsion	Brown Curtis (high pressure) and Parsons (low pressure) steam turbines, 21 Yarrow boilers, generating 37,000 shp

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Maximum speed	22¾ knots
Range	5,400 nautical miles at 10 knots
Armament	Ten 14-inch Mark I BL guns in five twin turrets
	16 6-inch Mark XI BL guns in single mounts
	Two 3-inch Mark I AA guns in single mounts
	Four 3-pdr signalling guns in single mounts
	Four submerged torpedo tubes, carrying 21-inch torpedoes
Protection	Belt: 4–9 inches
	Bulkheads: 3–4½ inches
	Barbettes: 4–10 inches
	Turret faces: 10 inches
	Conning tower: 11 inches
	Deck: 1–4 inches
Complement	1,167 officers and men

WARTIME MODIFICATIONS

It was inevitable that the super dreadnoughts of the Grand Fleet would be modified during their service lives. During the decade between 1905 and the outbreak of the war in 1914, new dreadnoughts or even whole classes of capital ships were being laid down every year, producing a rolling programme of shipbuilding. As it took upwards of two years to build a capital ship, the design of one class had to be approved before the ships built three years before had been in service long enough to be fully evaluated by the navy.

This meant that while in accordance with Fisher's dictum each subsequent class was 'better than the last', it often took three years to uncover flaws that could then be rectified on the drawing board. For instance, the problem with smoke interference to the gunnery directors in the control top of many British dreadnoughts was one that first became evident after the original *Dreadnought* entered operational service in early 1907. Attempts were made to alleviate the problem in the subsequent Bellerophon and St Vincent classes, but these modifications were not wholly satisfactory. Smoke interference was still a problem when the Orion class entered service in 1912, and the first design to be wholly free of the problem was the Iron Duke class, which was laid down in 1912 and entered service in 1914. Effectively this meant that it took naval designers upwards of six years to identify and then rectify the problem.

While little could be done to solve major design flaws, at least efforts were made to improve the performance of ships once they joined the fleet. These modifications tended to follow certain patterns. First, changes were made to fire control and gunnery direction systems to bring the whole battle fleet in line with the latest technological advances. Then came the modifications that resulted from the Battle of Jutland in 1916 and the nascent threat posed by enemy aircraft. These eventually resulted in the provision of aircraft to many capital ships in an effort to take advantage of improvements in maritime aviation.

Orion Class

1914–15: Director control towers added below control top in *Conqueror* and *Orion*. W/T poles fitted to tops of derricks. Splinter shields fitted to *Thunderer*'s 4-inch guns.

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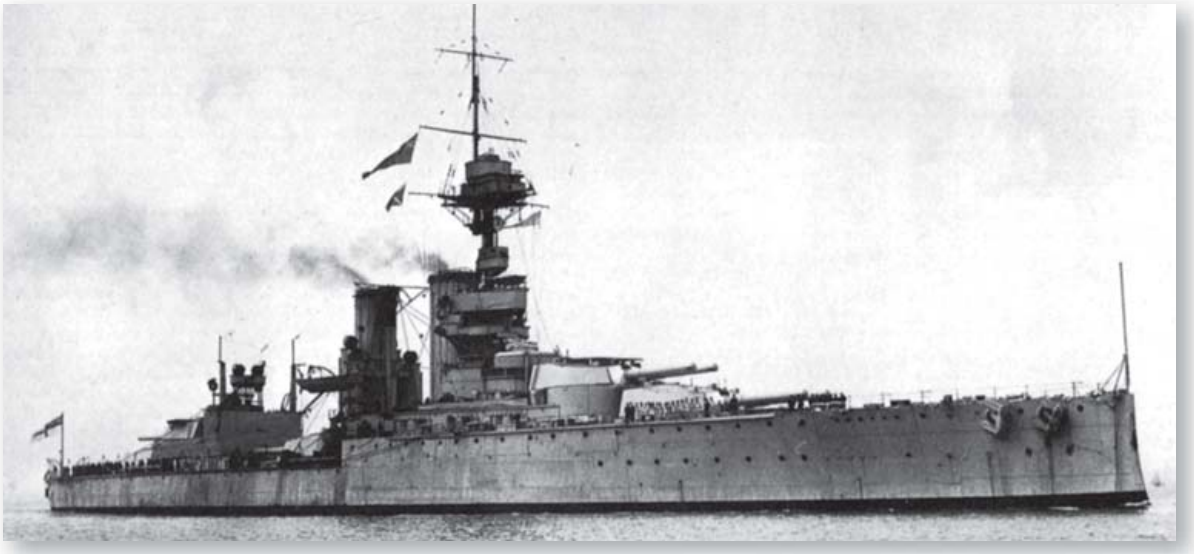

HMS *Centurion* photographed while at anchor in Scapa Flow during late 1917. A flying off platform has been mounted to 'B' turret and a range clock fitted to her foremast, below her new more rectangular control top. In early 1918, deflection scales were painted on the sides of 'B' and 'X' turrets.

1915–16: Torpedo nets removed. Bridge structure extended on *Monarch*, *Thunderer* and *Orion* (*Conqueror* had a larger bridge to begin with).

1916–17: Secondary armament reduced on a ship-by-ship basis. Kite balloon equipment added to *Monarch* and *Orion*. Anti-aircraft guns added to *Conqueror* (1917). Magazine protection upgraded after Jutland. Rangefinder baffles fitted to topmasts.

1917–18: Control tops enlarged and range clocks mounted on top of them. Deflection scales painted on turrets. 'Coffee box' searchlight towers added abaft after funnel. Rangefinder baffles removed. Flying off platforms added to 'B' and 'X' turrets ('B' and 'Q' in *Orion*, 'B' only in *Monarch*).

King George V Class

Note: *King George V* could be distinguished from her sisters as she had a plain pole foremast, rather than a tripod mast, and a smaller control top.

1914–15: 3-inch anti-aircraft gun installed on quarterdeck.

1915–16: Torpedo nets removed. Searchlights remounted on platform around after funnel. Topmast lowered.

1916–17: Rangefinder added over conning tower. 4-inch guns removed from after casemates (1917). Additional 3-inch anti-aircraft gun fitted. Magazine protection upgraded after Jutland. Rangefinder baffles fitted to topmasts (also to funnels of *Ajax*).

1917–18: Control tops enlarged, and range clocks mounted below them. Deflection scales painted on turrets. Stern torpedo tubes removed. 'Coffee box' searchlight towers replaced platform around after funnel. Rangefinder baffles removed. During 1918 flying off platforms added to 'B' turrets, as well as 'X' turret of *Centurion* and 'Q' turret of *King George V*.

Iron Duke Class

Note: *Emperor of India* could be distinguished from her sisters as she was the only vessel in her class not to have a sternwalk fitted to her stern.

1914–15: Topmasts reduced in height.

1915–16: After 6-inch guns removed and re-sited on forecastle deck amidships. Director control tower fitted for secondary guns in *Iron Duke*.

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Nets fitted around control tops of *Benbow* and *Emperor of India* as a range-baffling experiment.

1916–17: Control top enlarged. Rangefinder mounted on top of conning tower. In *Benbow* two searchlights moved from bridge to top of 'X' turret (late 1916). *Emperor of India* fitted with kite balloon equipment (late 1916). Deck protection over magazines upgraded after Jutland. Rangefinder baffles fitted to tripod legs.

1917–18: Deflection scales painted on turrets. Range clocks fitted to front of control tops and rear of after superstructure. 'Coffee box' searchlight towers added around after funnel. Clinker funnel cap added to forward funnel of *Emperor of India* (1917). Rangefinder baffles removed. During 1918 flying off platforms added to 'B' and 'Q' turrets.

Queen Elizabeth Class

Note: *Queen Elizabeth* could be distinguished from her sisters as she was the only vessel in her class to have a sternwalk fitted to her stern and to have 6-inch guns fitted in her after casemates.

1914–16: Nets fitted around control top of *Queen Elizabeth* as a range-baffling experiment. Nets removed in May 1915.

1916–17: Secondary control top added to mainmast. Modifications made to searchlight arrangement on a ship-by-ship basis. *Barham* and *Warspite* fitted with kite balloon equipment (late 1916). Deck protection over magazines upgraded after Jutland and magazine safety measures updated. Sternwalk removed from Queen Elizabeth (late 1916). Topmast reduced and rangefinder baffles fitted to foremast and mainmast.

1917–18: Deflection scales painted on turrets. 'Coffee box' searchlight towers added around after funnel. Rangefinder baffles removed. During 1918, flying off platforms added to 'B' and 'X' turrets in all ships apart from *Queen Elizabeth*.

Royal Sovereign Class

Note: *Ramillies* could be distinguished from her sisters as she was the only vessel in her class to have torpedo bulges fitted when she entered service.

1916–17: Searchlights added on top of control top on *Royal Oak* and *Royal Sovereign*. *Revenge* fitted with kite balloon equipment (late 1916). Rangefinder baffles fitted to funnel of *Royal Oak* and *Revenge* and to topmast of *Royal Oak*. These were removed in mid 1917. Magazine safety measures updated after Jutland.

By contrast, this photograph shows the *Emperor of India* as she appeared by the end of the war. The most striking difference was the addition of a clinker funnel cap over her forward funnel, a modification made in early 1918. The *Emperor of India* was the only warship in her class to be fitted with this device.

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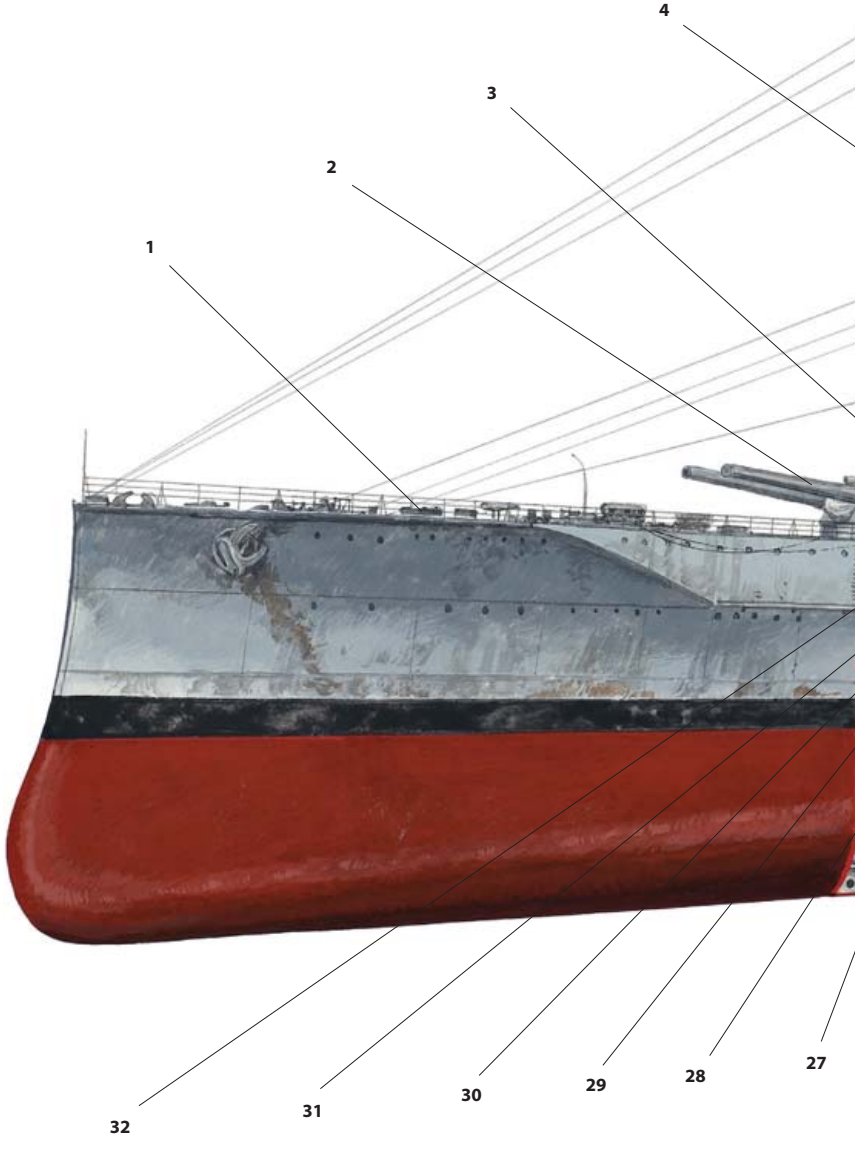
E

HMS *IRON DUKE*, MAY 1916

The *Iron Duke* won fame as Admiral Jellicoe's flagship at the Battle of Jutland, and it was on her bridge that the war at sea could have been 'lost in a single afternoon'. She served as the flagship of the Grand Fleet for over two years until relinquishing her status in January 1917, when Admiral Beatty hoisted his flag in the *Queen Elizabeth*. At Jutland she engaged the German High Seas Fleet and reportedly scored six hits on a König-class dreadnought. After the war she was demilitarized, and during World War II she returned to Scapa Flow to serve as a depot ship. As such, she was the longest-serving dreadnought in the fleet. The *Iron Duke* was the namesake ship of her class, which represented the final development of the super dreadnought, after the Orion and King George V classes that preceded her. Unlike these earlier super dreadnoughts, the four battleships of the Iron Duke class carried a secondary armament of 6-inch guns mounted in casemate positions in the superstructure, as it was now thought that the smaller 4-inch guns provided inadequate protection against enemy destroyers and torpedo boats. This cutaway view of her is based on her appearance when she joined the Grand Fleet in Scapa Flow in December 1914 as the fleet flagship, flying the flag of Admiral Jellicoe.

KEY

1. Forecastle, anchor cables and steam capstan
2. 13.5-inch 45 cal. BL gun Mark V (2 per turret)
3. Gun House
4. Conning Tower
5. Bridge
6. Admiral's Bridge and Searchlight Platform
7. Foremast
8. Gunnery Control Tower
9. Funnel (1 of 2)
10. 6-inch QF BL gun Mark VII (1 of 12 in single casemate mountings)
11. Searchlight Platform
12. Boat Deck
13. Q Turret
14. Foremast and After Spotting Top
15. After Gunnery Control Tower
16. Quarterdeck
17. Rudder
18. Propeller (1 of 4)
19. Engine Room
20. Steam Turbine (1 of 4)
21. Barbette for Q Turret
22. Boiler (1 of 18)
23. Engine Room Uptakes
24. Shell Room (1 of 2 per turret)
25. Cordite Magazine (1 of 2 per turret)
26. Double Bottom
27. Lower Handling Room
28. Compressed Air Tanks
29. Turret Hoist Mechanism (Machinery Deck)
30. Upper Handling Room
31. Cordite Room and Traversing Mechanism
32. Lower Gun House ('Gun Pit')



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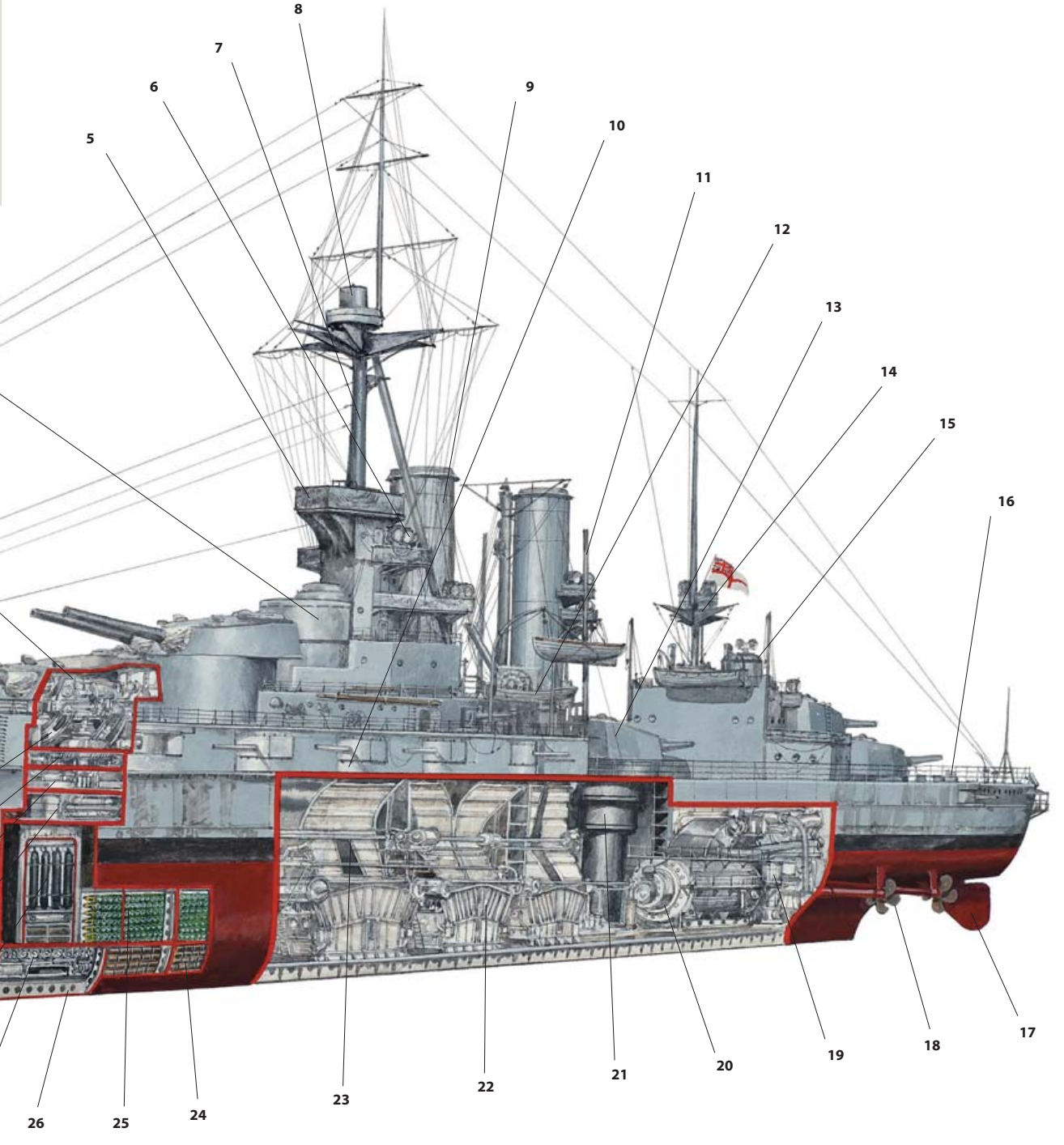

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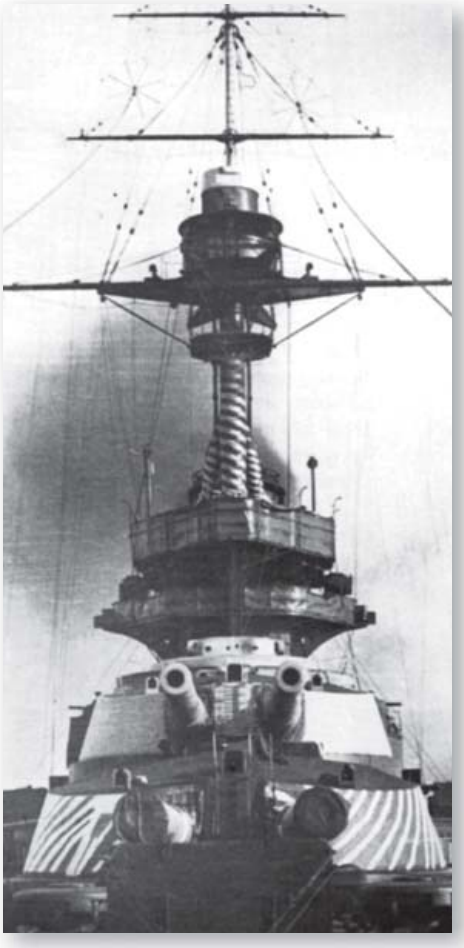
Although this Sopwith Pup is shown taking off from a flying off platform fitted to the battlecruiser *New Zealand*, both the aircraft and the platform were identical to those carried on many super dreadnoughts during the final years of the war.

In September and October 1914 the King George V-class super dreadnought *Audacious* was painted in an experimental camouflage scheme – one of the few dreadnoughts to wear camouflage before the final years of the war. It was generally felt that such schemes were unnecessary for capital ships of the main battle fleet.



1917–18: Control top enlarged. Deflection scales painted on turrets. Range clocks added to front of control top, and to rear of searchlight tower abaft mainmast. Rangefinder added to roof of control top. 'Coffee box' searchlight towers added around after funnel on all ships except *Ramillies*. Rangefinder baffles removed. Torpedo bulges fitted to *Revenge* and *Resolution* (late 1917–early 1918). Bridge structure enlarged. During 1918, flying off platforms added to 'B' and 'X' turrets.

HMS *Erin*

Note: Mainmast removed before *Erin* joined the fleet.

1914–15: Nets fitted around control top as a range-baffling experiment.

1915–16: 3-inch anti-aircraft gun added. Four signal guns removed. Topgallant mast removed (mid 1915).

1916–17: Director control for main guns fitted below control top. Secondary gun directors fitted and control top enlarged. Additional 3-inch anti-aircraft gun mounted.

1917–18: Control top enlarged. Deflection scales painted on turrets. Range clocks added below main director platform and to rear of after superstructure. 'Coffee box' searchlight towers added around after funnel. Rangefinder added to roof of control top. Flying off platforms added to 'B' and 'Q' turrets (early 1918).

HMS *Canada*

1915–16: No modifications.

1916–17: Foretopmast lowered. Searchlights mounted on after superstructure removed, and repositioned on a platform on either side of mainmast.

1917–18: Control top enlarged. Deflection scales painted on turrets. Range clocks added to rear of after superstructure. After pair of 6-inch guns removed. Searchlight position abeam of after funnel replaced by 'coffee box' searchlight towers. Range clock mounted above control top (early 1918). Flying off platforms added to 'B' and 'X' turrets (early 1918).

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CAMOUFLAGE

Many navies had experimented with camouflage before the outbreak of World War I, but it was only during this conflict that the Admiralty ever seriously considered using camouflage to break up the lines of British capital ships. While the general consensus was that camouflage schemes were inappropriate for dreadnoughts of the main battle fleet, a number of striking experiments were conducted in 1914 and were repeated intermittently throughout the war years. As the details of many of these experimental schemes were never properly recorded, we are left with fragmentary evidence based on photographs, administrative reports and personal accounts with which to reconstruct what these schemes looked like.

When the war began, the dreadnoughts of the battle fleet were painted in a dark slate grey colour scheme. White funnel recognition bands were used to tell ships of the same class apart, but these were painted over within weeks of the outbreak of war. By September most dreadnoughts and super dreadnoughts were repainted in an overall mid-grey scheme, which was felt would make the warships stand out less in North Atlantic waters.

The Admiralty consulted artists and academics in an effort to ascertain just what schemes would work best for the fleet. These experts felt that dark colours such as black or dark slate grey rendered warships particularly visible in poor light conditions, hence the move towards the repainting of the battle fleet. It was felt that lighter colours such as light grey or blue-grey hindered visibility and helped to break up the appearance of a warship. While most experiments were conducted on small ships, the dreadnoughts of the battle fleet were not immune to the camouflage experiments conducted during the opening months of the war.

In September 1914 *Audacious* and *Orion* were both painted in a complex 'leopard tone' scheme of black and white stripes applied to their gun turrets, funnels, masts and superstructure. This was an early version of the 'zebra pattern' or 'Admiralty Dazzle Pattern' used extensively during both world wars. Although both ships were repainted in overall grey in October, that winter several other capital ships were given their own experimental treatment. The battlecruiser fleet was painted in contrasting panels of white, medium and dark grey, while *Iron Duke* had the sides of 'A', 'B' and 'X' turrets painted white, along with her after superstructure. *Superb* bore a modified version of this, with patches of white and grey on her turrets and superstructure.

All of these camouflage schemes were the work of Professor Graham Kerr, a biologist from Glasgow University who had made a study of animal camouflage schemes. He described these as 'anti-shadow' or 'parti-colouring' schemes, designed to break up the profile of the warship and so baffle enemy rangefinders. He also experimented with a 'blotch scheme' to break up the outline of

In November 1917, two of the Royal Sovereigns were painted in dazzle camouflage schemes by way of an experiment. *Ramillies*, pictured here, was painted in black, yellow, light and dark blue, green and pink patches. The scheme was painted over the following March.

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The super dreadnought *Iron Duke*, pictured at anchor in Scapa Flow. At the outbreak of the war she became the flagship of the Grand Fleet and flew the flag of Admiral Sir John Jellicoe, remaining in that role until January 1917.

a ship. As a result, in late 1914 *Conqueror* retained her pre-war dark slate grey hull but had her upper works broken up by a mottled pattern of dark grey over white. There is evidence that other dreadnoughts were painted in these experimental schemes, but a lack of photographic evidence makes it impossible to identify which ships played their part in Professor Kerr's experiments. For the most part these schemes were abandoned in the summer of 1915, and the battle fleet was allowed to resume a more uniform appearance.

The exceptions were the dreadnoughts sent to the Mediterranean in 1915 to support the Gallipoli operation. Several ships were given a false bow wave to give a misleading impression of the ship's speed to any lurking U-Boat, but these were painted out a few weeks later when the ships returned to Scapa Flow.

During the winter of 1915–16 the experiments started again, with dreadnoughts sporting tiger stripes around their funnels, while others wore alternate dark and light panels on their hulls. At least six dreadnoughts, including the Orion-class super dreadnoughts *Conqueror* and *Monarch*, bore this scheme throughout the winter. Once more, after the spring the capital

The Royal Sovereign-class super dreadnought *Revenge*, pictured at anchor in Scapa Flow during March 1918. Her impressive experimental dazzle scheme designed by the artist Norman Wilkinson was painted over the following month.

F

HMS *KING GEORGE V* AT JUTLAND, 31 MAY 1916

In May 1916 the namesake of the King George V class was the flagship of Vice Admiral Sir Martyn Jerram, commander of the 2nd Battle Squadron of the British Grand Fleet. During the Battle of Jutland, the *King George V* was deployed on the left of the six columns of dreadnoughts that formed the battle fleet. When Admiral Jellicoe ordered the fleet to form into line to 'cross the T' of the approaching German battle fleet, the *King George V* became the leading ship of the British battle line. At 7.07pm she opened fire on the leading German ship, the battlecruiser *Derrflinger*, at a range of approximately 12,000 yards. This made her one of the first of the British dreadnoughts to engage the enemy. She was only able to fire two salvos before the German fleet conducted its 180° turn away from the British line and withdrew under cover of smoke. None of her 13.5-inch shells hit their target, although the fall of shot reportedly fell close to it. In this depiction of the battle, *King George V* is shown leading the British line shortly after she opened fire on the enemy.

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ships of the Grand Fleet reverted to their normal overall mid-grey colour scheme. This meant that the battle fleet had a relatively clean-cut appearance during the Battle of Jutland.

The experiments resumed in 1917, following the introduction of the 'Admiralty Dazzle scheme', developed by the artist Norman Wilkinson, then a lieutenant commander. Overall, 150 British warships were painted in the dazzle scheme during the final years of the war, together with numerous merchantmen. A wide range of colours and even patterns was used and the experiments in the Grand Fleet resumed in earnest, encouraged by experts from the Royal Academy of Art. *Ramillies* wore a particularly striking scheme from November 1917 until the following March, while her sister ship *Revenge* received a different pattern, one composed of an equally vivid range of blues, greys, yellows, whites, blacks and pinks.

While the Admiralty clearly thought all this experimentation was worthy, it made relatively little use of camouflage for its capital ships. In contrast the US Navy embraced the art of naval camouflage, and American capital ships frequently bore an array of schemes during the final years of the war. Generally, however, it was felt that camouflage was largely unnecessary for dreadnoughts that operated together as part of a battle fleet. For many of the crews, the whole business was probably a source of great amusement, and helped entertain the men of the Grand Fleet during those seemingly interminable winters at anchor in Scapa Flow.

The 'fast battleships' of the 5th Battle Squadron, pictured from a British airship as the Grand Fleet sailed to intercept the German High Seas Fleet after its surrender. These warships then escorted the enemy battle fleet into captivity in Scapa Flow.

THE WARTIME FLEET

Like the dreadnoughts described in NVG 200 *British Battleships 1914–18 (1)*, the super dreadnoughts described here tended to operate together, in cohesive divisions of the Grand Fleet. As they had to remain in constant readiness for battle against the German High Seas Fleet, they tended to remain in Scapa Flow, waiting for the great naval clash everyone was expecting. Therefore it is worth outlining the structure of this battle fleet.

The Grand Fleet was commanded by Admiral Sir John Jellicoe, whose fleet flagship was the *Iron Duke*. As such it remained nominally independent of the battle squadrons that formed the main building blocks of the dreadnought fleet. Of these, the 1st and 2nd battle squadrons were active elements of the fleet, while the 3rd Battle Squadron consisted of eight King Edward VII-class pre-dreadnoughts, known somewhat derisively as 'The Wobbly Eight'. In May 1916 these pre-dreadnoughts

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were moved down to the Nore, and so were no longer considered an active part of the Grand Fleet. By then the 4th Battle Squadron was formed, which meant at the Battle of Jutland, fought on 31 May 1916, the Grand Fleet's battle line consisted of 24 dreadnoughts and super dreadnoughts in three battle squadrons.

Each battle squadron was commanded by a vice admiral and was subdivided into two divisions, one of which was directly commanded by the squadron commander and the other by a rear admiral. In addition, the fleet contained the 5th Battle Squadron of Queen Elizabeth class 'fast battleships' (four of which were present at Jutland), and the battlecruiser squadron, which by May 1916 had become a battlecruiser fleet commanded by Vice Admiral Beatty, divided into three battlecruiser squadrons. At Jutland the 3rd Battlecruiser Squadron was attached to the main battle fleet, while the 'fast battleships' of the 5th Battle Squadron were attached to Beatty's semi-independent command. This squadron was commanded by Rear Admiral Evan-Thomas, who flew his flag in *Barham*. As his squadron consisted of just four 'fast battleships', it was not subdivided into divisions.

While the composition of squadrons and divisions remained fairly static throughout the war, there were occasional changes, particularly when capital ships were sent away for refitting or repair. At Jutland, the main battle fleet of 24 dreadnoughts was organized as follows:

2nd Battle Squadron		**4th Battle Squadron**		**1st Battle Squadron**	
1st Division	2nd Division	3rd Division	4th Division	5th Division	6th Division
King George V (squadron flag)	*Orion* (flag)	*Iron Duke* (fleet flag)	*Benbow* (flag)	*Colossus* (squadron flag)	*Marlborough* (flag)
Ajax	*Monarch*	*Royal Oak*	*Bellerophon*	*Collingwood*	*Revenge*
Centurion	*Conqueror*	*Superb* (squadron flag)	*Temeraire*	*Neptune*	*Hercules*
Erin	*Thunderer*	*Canada*	*Vanguard*	*St Vincent*	*Agincourt*

Thus, *Iron Duke* was essentially placed under the command of Vice Admiral Sturdee's 4th Battle Squadron even though she also acted as the fleet flagship. *King George V* and *Colossus* flew the flags of Vice Admiral Jerram and Vice Admiral Burney respectively. *Orion*, *Benbow* and *Marlborough* were the flagships of the rear admirals who acted as squadron second-in-commands and who commanded a division of the squadron.

The order in which the ships are listed above is the order taken by the battle fleet during its approach to battle at Jutland, with the Grand Fleet's dreadnoughts arrayed in six divisional-sized columns and the *King George V* leading the port column. At 6.15pm Jellicoe ordered his battle fleet to form line, which was achieved by simultaneously turning each division to port, the ships following their divisional leader in succession. Essentially this was a right-angled turn, which was soon followed by another right-angled turn, this time to starboard.

By the end of this complex manoeuvre the whole British dreadnought fleet had formed up into line astern, creating a battle line almost seven miles long, and was steaming at right angles to the approaching German battle fleet. As before, the *King George V* was in the lead, and the fleet flagship *Iron Duke* was the ninth dreadnought in the line. This meant that the British were

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'crossing the T' of the German fleet, which meant all of their ships could fire in broadside with all their guns, while the Germans could only reply with the forward guns of their leading ship.

By all the laws of naval warfare this battle-winning manoeuvre should have resulted in the annihilation of the German battle fleet. Instead, the Germans conducted a completely unexpected manoeuvre, the *Gefechtskehrtwendung*, a simultaneous reversal of course by the entire battle line. It saved the day for the Germans, leaving the British battle fleet with no targets save for a group of German battlecruisers, which soon beat a hasty retreat. While Jellicoe was denied his victory – the moment of glory his sailors had waited almost two years for – at least it demonstrated one thing. The British dreadnought fleet had the firepower and tactical skill to destroy its German opponents, and so the High Seas Fleet spent the rest of the war avoiding a naval showdown that it felt it could not win. While this meant another two years of tedium for the crews of Britain's dreadnoughts, at least they had demonstrated that, collectively, they had forged an unbeatable weapon of war.

WARTIME SERVICE

Orion Class

After commissioning in January 1912 *Orion* joined the Home Fleet in Portsmouth. Days later she was damaged in a collision with a pre-dreadnought, necessitating minor repairs. In August 1914 she joined the 2nd Battle Squadron of the Grand Fleet, and remained with the squadron until the end of the war. *Monarch*, *Thunderer* and *Conqueror* also joined the 2nd Battle Squadron following the outbreak of war. On 8 August *Monarch* was attacked by *U-15* off Fair Isle, but the torpedoes missed. This was the first torpedo attack of the war against a British warship. On 27 December, *Monarch* and *Conqueror* collided in Scapa Flow and the two warships were sent to Devonport for repairs, rejoining the fleet in late January and March respectively.

The Grand Fleet at sea, before carrying out a sweep of the North Sea in late 1917. In the foreground is the super dreadnought HMS *Orion*, and behind her are other Orion-class super dreadnoughts and dreadnoughts from the US squadron.

G

HMS *BENBOW* ON EXERCISE, 1918

Between Jutland and the end of the war the super dreadnoughts of the Iron Duke class underwent several minor modifications. *Benbow* had her control top modified, her searchlights were moved from the bridge wings to the top of 'X' turret, and rangefinder baffles were fitted to her forefunnel and derrick. Then, in late 1917, like most battleships in the fleet, deflection scales were painted in black and white on to the sides of 'B' and 'X' turrets to help improve the accuracy of gunnery. Similarly, range clocks were mounted on the front of the control top and a new searchlight platform was built around the second funnel. Unlike many other dreadnoughts, *Benbow* was spared the addition of a flying off platform mounted on 'B' and 'X' turrets and funnel baffles to direct smoke away from the control top. After Jutland, some of the Grand Fleet were based at Rosyth in the Firth of Forth, where they were better placed to react to an unexpected German sortie than if the ships had remained in Scapa Flow. Its proximity to Edinburgh also made this forward base popular with the ship's company. In this scene, *Benbow* is pictured lying off Rosyth, conducting a damage control exercise in the lee of the Forth Rail Bridge.

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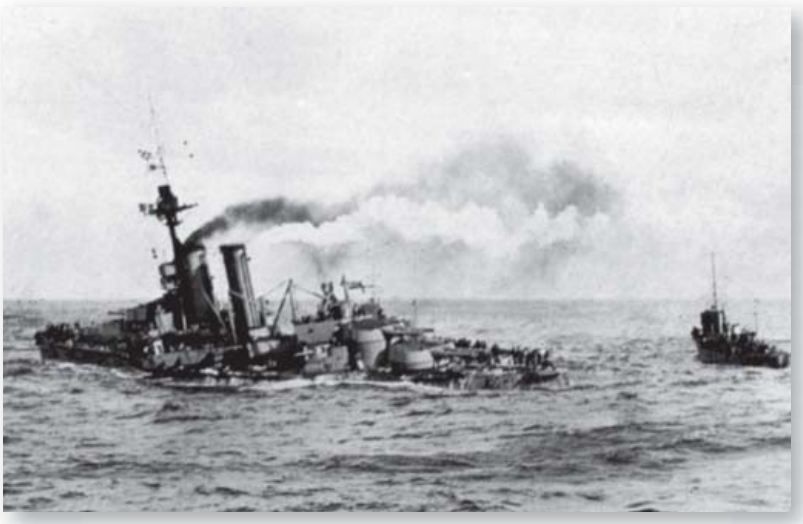

The sinking of the King George V-class super dreadnought *Audacious* off the Irish coast on 27 October 1914.

By May 1916 the 2nd Battle Squadron was based in the Cromarty Firth, and it was from here that the four Orion class battleships sailed for Jutland. *Orion* claimed four hits on the German battlecruiser *Lützow*. For the rest of the war the Orions were engaged in frequent sweeps and patrols, but no further action. In April 1916 the Orions moved to Rosyth in the Firth of Forth, and operated from there until the war's end.

King George V Class

On commissioning in November 1912 *King George V* joined the Home Fleet based in Portsmouth, and was the British flagship during the celebrations surrounding the opening of the Kiel Canal in June 1914. She then went into refit until the following March, when she joined the 2nd Battle Squadron, based in Scapa Flow. She remained with the Grand Fleet until the end of the war. In May 1913 she was joined in Portsmouth by *Centurion*, and in October by *Audacious* and *Ajax*. Together they formed a homogenous division of the 2nd Battle Squadron. On 27 October 1914, after finishing a refit in Portsmouth, *Audacious* was taking part in gunnery drills off the southern coast of Ireland when she struck a mine, and she sank eight hours later despite the best efforts of her crew to save her. Her crew suffered no casualties in the disaster. In May 1916 the three remaining ships of the class were moved to the Cromarty Firth with the rest of the 2nd Battle Squadron, and they were all present at Jutland, when *King George V* was one of the first British dreadnoughts to open fire on the enemy. These three ships remained with the Grand Fleet for the remainder of the war, although *Centurion* was detached for a brief refit after Jutland.

Iron Duke Class

Iron Duke was commissioned in Portsmouth in March 1914 and joined the Home Fleet as its flagship. In June she was joined there by *Marlborough*, followed by *Benbow* and *Emperor of India*. After the outbreak of war they formed part of the Grand Fleet, and *Iron Duke* became the fleet flagship, flying the flag of Admiral Jellicoe. The Iron Dukes spent much of the war in Scapa Flow, despite conducting occasional sweeps and sorties in the North Sea. In January 1916 *Iron Duke* rammed and sank an oil tanker, but suffered minimal damage herself. The *Emperor of India* was undergoing a refit in May 1916, and so she missed the Battle of Jutland. However, the remaining three ships of the class all fought in the battle and engaged the German fleet. At 6.54pm on 31 May *Marlborough* was struck by a torpedo, but the flooding was brought under control and she remained in the battle line. She even engaged and damaged a German light cruiser shortly after 9pm. A few minutes later she fired 14 salvos at a König-class dreadnought,

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The Iron Duke-class super dreadnought HMS *Marlborough*, pictured under way in the North Sea during early 1918. This dreadnought served as the flagship of the 1st Battle Squadron until February 1917.

forcing her out of the German battle line. She then fired a torpedo at an enemy cruiser and engaged a flotilla of German destroyers, reportedly scoring two hits. She eventually managed to limp into the River Humber and was repaired in Tyneside. *Iron Duke* and *Benbow* had a less spectacular battle, but the fleet flagship obtained six hits on a König-class dreadnought. *Marlborough* rejoined the fleet in late July, and the Iron Dukes remained with the Grand Fleet until the end of the war. On 28 November 1916 Admiral Beatty assumed command of the fleet and flew his flag in *Iron Duke* until January, when he made *Queen Elizabeth* his flagship.

Queen Elizabeth Class

Queen Elizabeth was commissioned in December 1914 but remained on independent service until February 1915, when she was sent to the Dardanelles. She engaged Turkish coastal defences there, and subsequently fired on the German battlecruiser *Goeben*, but scored no hits. She returned home in May and joined the 5th Battle Squadron of the Home Fleet. In January 1917 she became the fleet flagship, flying the flag of Admiral Beatty. Therefore it was aboard her that the terms of the naval armistice were worked out on 15 November 1918 as she lay anchored in the Firth of Forth off Rosyth. *Warspite* joined the Grand Fleet in April 1915 but grounded in September and spent two months in dry dock in Scapa Flow. Her place was taken by *Barham*, which joined the 5th Battle Squadron in October. A few weeks later she collided with *Warspite*, but both ships suffered only minor damage. *Valiant* joined the squadron in January 1916, followed by *Malaya* in April. The *Queen Elizabeth* was undergoing a refit and missed the Battle of Jutland, but the other four 'fast battleships' all played an active part in the battle. *Warspite* fired 259 15-inch shells during the battle and received

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The 'fast battleship' *Queen Elizabeth*, the namesake of her class, leaving Mudros in the Aegean island of Lemnos in February 1915. A white triangle has been painted on her stem to simulate a bow wave, designed to confuse Turkish shore gunners.

13 hits, one of which affected her steering, but none were serious enough to cause significant damage. She was able to make it home to Rosyth for repairs and rejoined the squadron in July, just in time to collide with *Valiant*, necessitating further repairs. *Malaya* fired 215 15-inch shells at Jutland and was hit at least seven times, causing 96 casualties, 63 of them fatal. She rejoined the squadron in late June. *Valiant* fired 288 shells at the enemy battlecruiser squadron, but only sustained splinter damage in return. *Barham* fired 337 15-inch shells but took six hits from the enemy battlecruisers, none of which were particularly serious. However, she reportedly inflicted considerable damage on the German battlecruisers *Von der Tann*, *Derrflinger* and *Seydlitz*. After Jutland, the ships of the 5th Battle Squadron remained with the Grand Fleet for the duration of the war but saw no further action.

Royal Sovereign Class

Revenge was commissioned in February 1916 and joined the 1st Battle Squadron of the Grand Fleet, where in May she was joined by *Royal Sovereign*, which, despite not being the first of her batch to be commissioned, was still the official namesake of her class. *Royal Oak* joined the squadron at the same time. *Royal Sovereign* missed Jutland due to mechanical failure, but *Revenge* and *Royal Oak* engaged the enemy battlecruiser fleet, firing 102 and 38 15-inch shells respectively, scoring several hits on *Derrflinger* and *Von der Tann*. Neither ship was hit in return. *Resolution* joined the squadron in December, followed by *Ramillies* the following September, becoming the last British capital ship to join the Grand Fleet before the end of the war. By late 1916 these ships had moved to Rosyth in the Firth of Forth, which remained their base until the end of the war. They saw no further action after Jutland.

Other Super Dreadnoughts

Erin joined the Grand Fleet in September 1914 as part of the 4th Battle Squadron. She was transferred to the 1st Battle Squadron in October and remained there for the remainder of the war. She fought at Jutland but sustained

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no damage. The wartime purchase *Canada* was commissioned in October 1915, when she was sent to Scapa Flow to join the 4th Battle Squadron of the Grand Fleet. She fought at Jutland, firing 42 14-inch shells but scoring no acknowledged hits, and received no hits in return. After the battle she was transferred to the 1st Battle Squadron but saw no further action.

BIBLIOGRAPHY

Archibald, E. H. H., *The Fighting Ship in the Royal Navy, AD897–1984*, Blandford Press (Poole, 1987)

Attwood, E. L., *Warships: A Text Book on the Construction, Protection, Stability, Turning of War Vessels*, Longman (London, 1911)

Brown, David K., *The Grand Fleet: Warship Design and Development, 1906–1922* Seaforth Publishing (Barnsley, 1997)

Brown, David K., *Warrior to Dreadnought: Warship Design and Development, 1860–1905*, Seaforth Publishing (Barnsley, 2010)

Burt, R. A, *British Battleships of World War 1* Seaforth Publishing (Barnsley, 2012)

Campbell, John, *Jutland: An Analysis of the Fighting*, Conway Maritime Press (London, 1986)

Fawcett, H. W. and Hooper, G. W. W, *The Fighting at Jutland*, Chatham Publishing (London, 2001)

Friedman, Norman, *Battleship Design and Development, 1905–1945*, Smithmark Publishing (New York, NY, 1979)

Gardiner, Robert, *The Eclipse of the Big Gun: The Warship 1906–45*, History of the Ship Series, Conway Maritime Press (London, 1992)

Gardiner, Robert (ed.), *Conway's All the World's Fighting Ships, 1906–1921*, Conway Maritime Press (London, 1985)

Hodges, Peter, *The Big Gun: Battleship Main Armament, 1860–1945*, Conway Maritime Press (London, 1981)

Howarth, David, *The Dreadnoughts*, Time-Life Books (Alexandria, VA, 1980)

Le Fleming, H. M., *Warships of World War 1(1): Battleships*, Ian Allen (London, 1961)

Marder, Arthur J., *From the Dreadnought to Scapa Flow*, Oxford University Press (Oxford, 1966), 5 volumes

Massie, Robert K., *Dreadnought: Britain, Germany and the Coming of the Great War*, Random House (London, 1993)

Moore, John (ed.), *Jane's Fighting Ships of World War 1*, Studio Editions, (London, 1990)

Padfield, Peter, *Guns at Sea*, Hugh Evelyn Ltd (London, 1973)

Parkes, Oscar, *British Battleships, 1860–1950*, Seeley, Service & Co., Sons (London, 1973)

Pears, Randolph, *British Battleships, 1892–1957: The Great Days of the Fleets* (London, Godfrey Cave Associates, 1957)

Thomas, Roger D. and Patterson, Brian, *Dreadnoughts in Camera, 1905–1920*, Sutton Publishing (Stroud, 1998)

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INDEX

References to images and illustrations are in **bold**; captions to illustrations are in brackets.

Admiralty, the 4, 5, 8, 16, 22; and paintwork 37, 40; and weaponry 6, 7, 10, 14, 17, 20, 21
aircraft 31, **36**
anti-torpedo reinforcement **11**
Argentina 25
armistice 45
armour **6**, 7, 11, **14**, 15, **16**, 22, **24**, **26**
Armstrong shipyard 23, 25

Baron, RADM Hugh 6
batteries 14
battlecruisers 10, 14, 41
beam 7, 11, 15, 20, 22
Beatty, Vice Adm David 41, 45
Bellerophon Class 31
belts **6**, 7, **14**, 15, **16**, 22
boilers 16, 21, 24
Brazil 23, 25, 26
bridge 10, 11, 32
bulkheads 11, 15, 18, 20–1
buoyancy 15
Burney, Vice Adm Cecil 41

camouflage **13** (12), **36**, 37–8, 40
Canada, HMS **27** (26); design and development 25–6; modifications 36; specifications 30–1; wartime service 47
capital ships 5, 14, 16, 17, 21, 22, 25, 31, 40
casemates 10, 15, 20, 24, 26
centreline 4, 6, 7
Chile 17, 25, 26
Churchill, Winston 17
coal 15, 20, 22
Colossus Class 6, 7–8
command and control 11
conning tower 11, 33
control top 7, 11, 15, 31, 32, 33, 36
Cromarty Firth 44

Dardanelles *see* Gallipoli Campaign
dazzle scheme 40
deflection scales **10**, 32, 33, 36
destroyers 10
d'Eyncourt, Eustace Tennyson 16, 21–2
Director of Naval Construction (DNC) 6, 7, 10, 16, 17, 21
Director of Naval Ordinance (DNO) 6, 10, 14, 17, 20
displacement 7, 10, 11, 12, 15, 24
draught 11, 12

electrical circuits 7
Elswick Ordnance Factory 17, 20, 25
enemy aircraft 31
engines 7, 11, 16; oil-fired 20, 22
Erin, HMS **27** (26); design and development 23–5; modifications 36; specifications 30; wartime service 46–7
Evan-Thomas, RADM Hugh 41

'fast battleships' 17, 20, 21, 22, 26, **40**, 41
finances 12, 14, 17, 21
fire control 6, 11, 15, 24, 26, 31, 36
First Balkan War (1912–13) 23
Firth of Forth **17**, 44, 45, 46
Fisher, Adm John 4, 6, 8, 12, 14, 16, 31
flying off platforms **17**, **18**, 32, 33, 36
forecastle **11**, 15
foremast 7, 10, 11, 15, 32
funnels 7, 10, 15, 25, 33

Gallipoli Campaign (1915) 38, 45
Germany 4, 5, 7, 17, 24; *see also* High Seas Fleet
Grand Fleet **4**, 12, 25, 26, 31, 40, 41, 44
Great Britain 4–5, 12
gun range 4, 6

High Seas Fleet 5, 40, 42, 44–5, 46
Home Fleet: 1st battle squadron 40, 46; 2nd Battle Squadron 12, 40, 42, 44; 3rd battle squadron 40; 4th battle squadron 41, 46, 47; 5th battle squadron 41, 45, 46
hull 4, 7, 14, 20, 22, 24, 26

Iron Duke Class 12, 17, 18, 20, 21, 22, 24, 31; design and development 14–16; modifications 32–3; specifications 28–9; wartime service 44–5

Japan 5, 17
Jellicoe, Adm Sir John 40, 41, 42, 44
Jerram, Vice Adm Martyn 41
John Brown shipyard 23
Jutland, battle of (1916) 5, 26, 31, **39** (38), 40, 41–2, 44, 45–6, 47

Kerr, Prof Graham 37–8
Kiel Canal 44
King Edward VII Class 40–1
King George V Class 14, 16, 24; design and development 8, 10–12; modifications 32; specifications 28; wartime service 44
kite balloons **15**, 32, 33

living quarters 8, 24

magazine protection 32, 33
manoeuvres 41–2
mines 11, 44
modifications 31–3
Moore, RADM Henry 10, 17

Nelson Class 21
North Atlantic Ocean 37
North Sea 44

oil 20, 22
Orion Class 10, 11, 16, 23, 24; design and development 6–8; modifications 31–2; specifications 28; wartime service 42, 44

paintwork **13** (12), 37–8, 40
Portsmouth 21, 42, 44
propulsion 11, 20–1

Queen Elizabeth Class 5, 22, 41; design and development 16–18, 20–1; modifications 33; specifications 29; wartime service 45–6

range clocks 32, 33, 36
rangefinder baffles 32, 33, 36
refuelling 20
Revenge Class *see* Royal Sovereign Class
Royal Academy of Art 40
Royal Navy 17, 25; *see also* Admiralty; Grand Fleet; Home Fleet
Royal Sovereign Class 5, 17; design and development 21–3; modifications 33, 36; specifications 30; wartime service 46

St Vincent Class 7, 31
Scapa Flow **4**, **15**, **24**, **25**, **32**, 38, 40, 42, 44, 45, 47
sea conditions 15

searchlights 32, 33, 36
secondary armament 7, 10, 11, 14, 15, 20, 22, 24, 25, 32
ships, Brazilian 25
ships, British: *Agincourt,* HMS 25; *Ajax,* HMS **10**, 12, 32, 44; *Audacious,* HMS 11, 12, **13** (12), **36**, 37, 44; *Barham,* HMS 21, 33, 41, 45, 46; *Benbow,* HMS **16**, 33, 41, **43** (42), 44, 45; *Centurion,* HMS 12, 32, 44; *Colossus,* HMS 41; *Conqueror,* HMS 7, 31, 32, 38, 42; *Dreadnought,* HMS 4, 14, 16, 31; *Eagle,* HMS 26; *Emperor of India*, HMS 16, **29**, 32, 33, 44; *Iron Duke,* HMS 5, 14, 16, 32, **34–5** (34), 37, **38**, 40, 41, 44, 45; *King George V,* HMS **10**, **11**, 12, 32, **39** (38), 41, 44; *Malaya,* HMS **17**, 21, 45, 46; *Marlborough,* HMS **13** (12), **15**, 16, 41, 44–5; *Monarch,* HMS 8, 32, 38, 42; *Neptune,* HMS 6; *New Zealand,* HMS **36**; *Orion,* HMS **8**, 31, 32, 37, 41, 42, 44; *Queen Elizabeth,* HMS 17, 20, 21, 33, 45, **46**; *Ramillies,* HMS 22, 23, 33, 36, **37**, 40, 46; *Resolution,* HMS **19** (18), 22, 23, 36, 46; *Revenge,* HMS 22, 23, 33, 36, **38**, 40, 46; *Royal Oak,* HMS 22, 23, 33, 46; *Royal Sovereign,* HMS 23, 33, 46; *Superb,* HMS 37; *Thunderer,* HMS 5, 8, **9** (8), 31, 32, 42; *Valiant,* HMS **20**, 21, 45, 46; *Warspite,* HMS 5, **19** (18), 21, 33, 45–6; *see also Canada,* HMS; *Erin,* HMS
ships, Chilean 25–6
ships, German: *Derrflinger* 46; *Goeben* 45; *Lützow* 44; *Seydlitz* 46; *Vonn der Tann* 46
ships, Turkish: *Reshadieh* 23–4; *Sultan Osman I* 21, 23
slide mechanism 7
smoke 7–8, 10, 15, 20, 31
specifications 28–31
speed 7, 11, 16, 18, 20, 21, 26
splinter shields 31
Sturdee, Vice Adm Doveton 41
supplies 15

Thurston, Sir Richard 23
torpedo nets 32, 33, 36
torpedoes 7, 10, 14, 22, 42, 45
towing equipment **15**
Tsushima, battle of (1905) 17
Turkey 21, 23, 24, 25, 45
turrets 6, 7, **10**, 11, 14, **17**, 18, 20, 21–2, 24, 33, 36

U-Boats 38, 42
underwater protection 7, 22
United States of America 5, 17, 25, 40

Vickers shipyard 23, 25
visibility 11

Watts, Sir Philip 6, 7, 16, 17–18, 20, 21
weaponry: 6-inch guns 14–15, 18, 20, 22, 24, 25–6, 32; 12-inch guns 4, 6, 7, 25; 13.5-inch guns 6, 7, 11, 17, 24; 14-inch guns 5, 17, 18, 25; 15-inch guns 5, 20, 21, 22; anti-aircraft guns 32, 36; quick-firing guns 14, 15; shells 11, 18, 25, 46
weight 7, 10, 11, 18, 22, 25
Wilkinson, Norman 40
World War I (1914–18) 17, 24, 37

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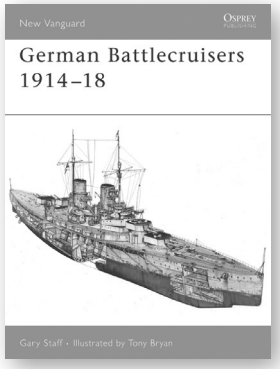

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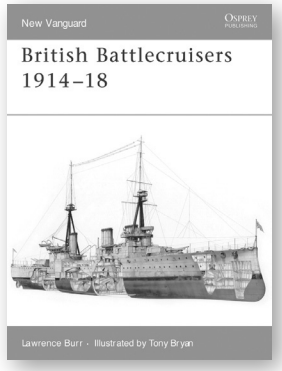

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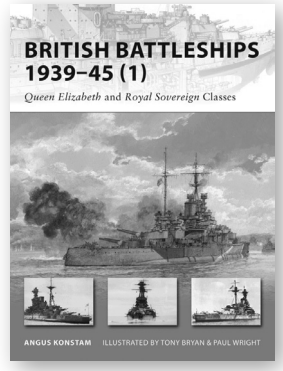

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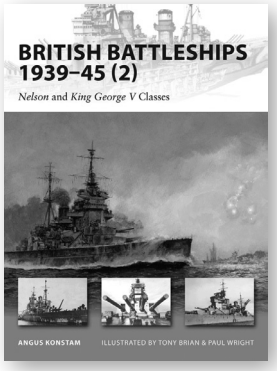

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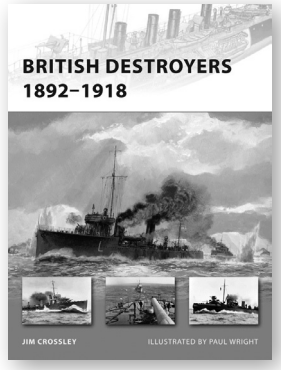

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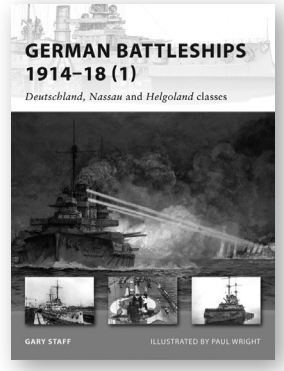

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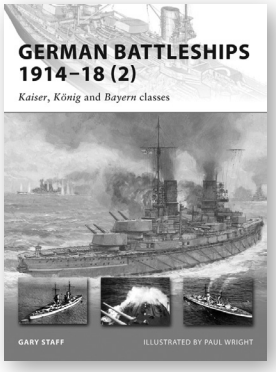

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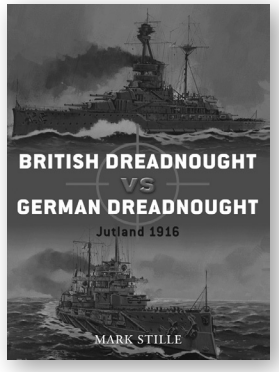

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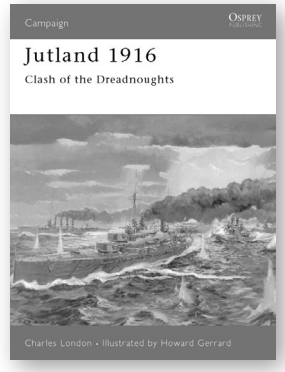

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EDITOR'S NOTE

Unless otherwise noted, all photos are from the Stratford Archive.

For ease of comparison please refer to the following conversion table:

1 mile = 1.6km
1yd = 0.9m
1ft = 0.3m
1in = 2.54cm/25.4mm
1 gallon (Imperial) = 4.5 litres
1lb = 0.45kg